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The real Babbage, a convivial man, looks solemn in 1850 daguerreotype.

He tried to get the government to change the traditional values of pounds, shillings and pence for a decimal system. He got about as far as American scientists have today after years of pleading in vain to introduce the metric system. Still, the British adopted his proposed two-shilling piece, or florin, making ten florins equal to a pound sterling.

Babbage never fully finished the expanded Difference Engine, which he began calling the "Analytical Engine," but parts of the original ran smoothly in displays and kept bringing him more attention. "Now Mr. Babbage," said one woman after listening to his explanation of it, "there is only one thing that I want to know. If you put the question in wrong, will the answer come out right?" People eventually learned that a computer is no smarter than its programmer. As the saying goes, "Garbage in, garbage out."

Babbage was a splendid host. The Duke of Wellington came to call. So did Charles Dickens. Babbage talked shop with Sir Charles Wheatstone, inventor of the Wheatstone bridge for measuring electrical resistance; with Joseph Whitworth, whose rifle cannon with hexagonal bores were bought by the Confederate States of America and used with deadly accuracy on unfortunate Union troops; with Isambard Kingdom Brunel, builder of the giant iron ship *Great Eastern* (SMITHSONIAN, November 1994).

Above all, there was Augusta Ada Byron, daughter of the poet. She was a brilliant and beautiful woman, whom Byron had named "Augusta" after his half-sister, who was also his mistress.

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Though Augusta Ada was her daughter, Lady Byron never forgave the girl for having the same name as the woman she despised.

Ada was skilled at mathematics and one of the few people able to understand and explain what Babbage's inventions were all about. It was a chaste affair—Ada was married to the Earl of Lovelace. But she devoted years to helping Babbage, writing explanations of his achievements and dreams, admiring him with professional as well as filial devotion. She wrote up some of his notes so well that he wanted to publish them under her byline. She declined. Yet when he rewrote a bit of her copy—just changing a word or two—she made it clear that no one *ever* rewrites a Byron.

Like a number of Victorians, Ada became an opium addict. During her grim death from cancer, her mother hid the opium she was then using to ease the pain so that Ada would suffer more—and repent. Her death left Babbage bereft of the woman whom Anthony Hyman describes as "his beloved interpretress." His plans called for a punch-card system that would command the functions of the still-theoretical machine. He got the card idea from a famous French loom introduced in the early 1800s by Joseph Marie Jacquard that used selected cards to automate the weaving of multicolored patterns. It was Ada who could best express what the card system would do for Charles' machine: "We may say most aptly that the Analytical Engine *weaves algebraic patterns* just as the Jacquard-loom weaves flowers and leaves."

Though Babbage's ideas for storing information exist only in his voluminous plans, his concepts kept nudging closer to our computer age. A card system was vital to the earliest electronic computers, post-World War II devices that filled a whole room.

The Scheutz Difference Engine also links us with the early days of the Smithsonian. Joseph Henry, the first Secretary of the Institution, visited Babbage in 1837 and wrote: "He, more, perhaps, than any man who ever lived, narrowed the chasm [separating] science and practical mechanics." A mild assessment. Judging Babbage today, as computers whir all around us, making possible a life experience that extends from spaceflight to the Internet, it is hard not to regard this 19th-century prophet with bewildered awe.

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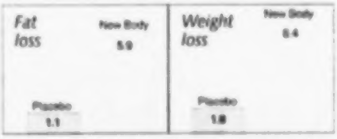

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Smithsonian Highlights

Plan a Smithsonian visit in 1996!

Join in the fun as the Smithsonian celebrates its 150th anniversary with a year-long schedule of special exhibitions and events. *Receive a free Associates' planning packet.* Write Smithsonian Information, Smithsonian Institution, Washington, D.C. 20560, or call (202) 357-2700 (voice) or (202) 357-1729 (TTY), 9 A.M.-5 P.M., Monday-Friday; 10 A.M.-4 P.M., Saturday-Sunday. *Note:* Parking near the Smithsonian is limited. The Metrorail subway system, convenient to all museums, has parking available at some stations (details in packet).

Begin your visit at the Smithsonian Information Center's Associates' Reception Desk—open 9 A.M.-4 P.M. daily—in the Castle. Special materials await you there. The National Museum of Natural History offers Associates a discount on daily buffet service, 11 A.M. - 3 P.M.

Museum Hours

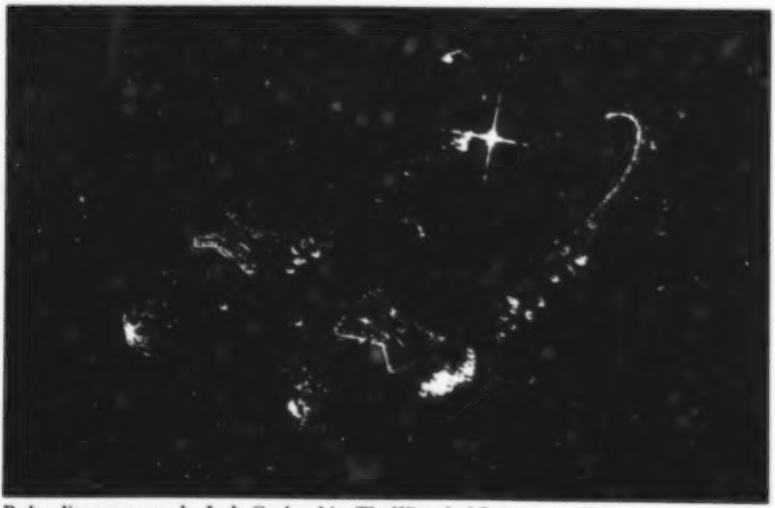
Smithsonian museums are generally open 10 A.M.-5:30 P.M. daily, except December 25. Hours at the National Zoo are 9 A.M.-4:30 P.M. daily for buildings, and 8 A.M.-6 P.M. for grounds.

Smithsonian Web Site

The Smithsonian home page on the World Wide Web (http://www.si.edu) offers on-line information about exhibitions, collections, events, products, and exhibits and activities commemorating the Institution's 150th anniversary.

"America's Smithsonian"

More than 300 Smithsonian treasures will leave their home in Washington, D.C. and head west for the grand opening of "America's Smithsonian," the traveling exhibition that is the centerpiece of the Institution's 150th-anniversary celebration. Opening February 9 at the Los Angeles Convention Center and running through March 7, the show features such artifacts as George Washington's sword, the ruby slippers from *The Wizard of Oz*, a Wright brothers' plane, Inaugural gowns worn by Patricia Nixon and Jacqueline Kennedy, and a meteorite from Mars. *Note:* Admission is free, but passes are required. Advance passes may be obtained for a service fee of $3.50 each by calling 1-(800)-913-TOUR.



Ruby slippers worn by Judy Garland in *The Wizard of Oz* are one of the treasures going on the road in "America's Smithsonian," opening February 9 in Los Angeles.

Smithsonian Musical Weekend

The 24th annual Smithsonian Musical Weekend will be held April 26-28. Highlights include performances by the National Symphony Orchestra and the Smithsonian's Chamber Music Society, and a jazz brunch in the Smithsonian Castle. For information and reservations, call (202) 973-2162.

Special February Exhibits, Events

National Museum of American Art

Metropolitan Lives: The Ashcan Artists and Their New York (through March 17) Paintings, pastels, drawings and prints by America's "Ashcan School" artists. See *Highlights Continued*, page 28. For images and information, see show's World Wide Web site: http://www.nmaa.si.edu/metlives/ashcan.html.

Chaim Gross: A Celebration (through May 13) Exhibit celebrating the recent gift of Gross' 1932 wood sculpture *Acrobatic Performers* explores the artist's affinity for the subject of the acrobat.

Renwick Gallery

American Crafts: The Nation's Collection (runs indefinitely) Selection of 19th- and 20th-century works from the permanent collection by nationally prominent artists in a variety of craft media.

National Portrait Gallery

Rebels: Painters and Poets of the 1950s (through June 2) Exhibition examines the artists and writers of the Beat Generation and the New York School, including Jack Kerouac, Allen Ginsberg, Jackson Pollock and Mark Rothko.

From Truman to Clinton: Presidents on Time (through July 21) Portraits drawn from the gallery's collection of original *Time* magazine cover art.

National Air and Space Museum

Africa: The Serengeti (6:15 P.M. daily) New Imax film tells the story of the greatest migration of land animals on Earth.

Flights of Fancy: Photographs by Jacques-Henri Lartigue, 1904-1922 (through March 3) Images capture the pioneering days of aviation.

The Enola Gay (runs indefinitely) Exhibition features the forward fuselage of the *Enola Gay*, the B-29 that dropped the atomic bomb on Hiroshima. For information, call (202) 786-2122.

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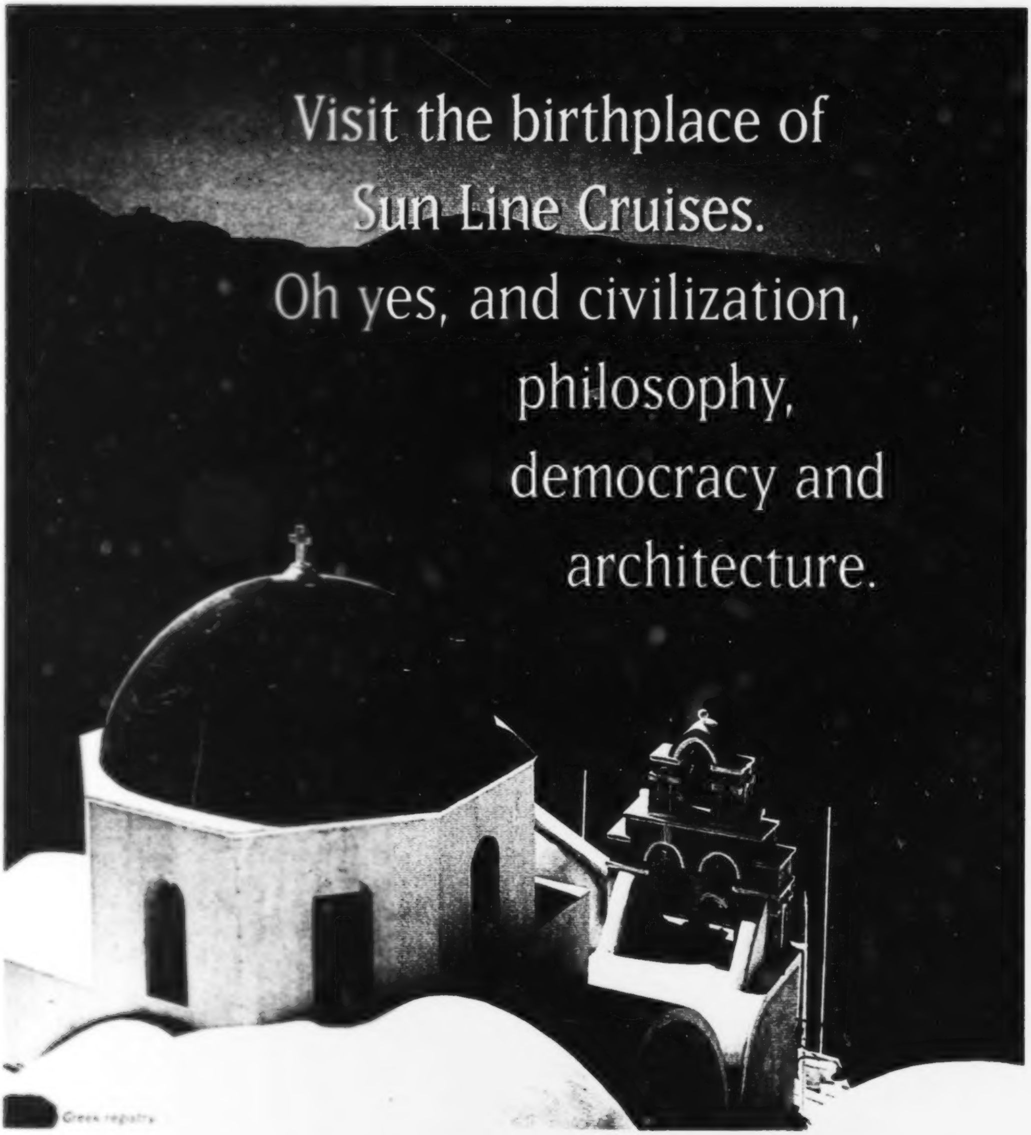

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Jacques-Henri Lartigue caught takeoff in Rouzat, France, of experimental glider designed by his brother Zissou in 1910. Photograph is in "Flights of Fancy" at NASM.

The New Solar System (opens February 23) New Einstein Planetarium show. *Note:* The planetarium will be closed February 5-22.

National Museum of Natural History

Science at Sea (opens February 2) Display celebrates the 125th anniversary of the Smithsonian's collaboration with the National Marine Fisheries Service.

Landscape Kimonos by Itchiku Kubota (through April 14) Japanese artist Itchiku Kubota revived an ancient pattern-dyeing technique to create an elaborate series of handcrafted kimonos.

Exploring Marine Ecosystems Newly renovated permanent exhibition in the Sea Life Hall explores a tropical coral reef and a temperate rocky shore.

Gems and Minerals Hall Gallery is closed for renovation until December 1996. The famous Hope Diamond is on view on the second floor of the Rotunda.

National Zoological Park

Think Tank New permanent exhibit takes a look at the biology and evolution of animal thinking, focusing on orangutans, monkeys and leaf-cutter ants.

Pollinarium Permanent installation examines the means of plant reproduction.

National Museum of American History

USS Monitor (through April 28) Exhibit relates the tale of the famous Civil War ironclad vessel.

Science in American Life Permanent exhibition tracks advances and discoveries in science over the past 125 years—from aspirin to the atom.

Personal Legacy: The Healing of a Nation (runs indefinitely) Show commemorating the tenth anniversary of the Vietnam Veterans Memorial looks at objects and documents left at The Wall.

National Postal Museum

Located next to Union Station on Capitol Hill, the museum presents exhibits that trace the history of the nation's mail service.

Fakes and Forgeries (opens February 9) Exhibition focuses on some of the more interesting cases of philatelic forgery.

The Castle—Great Hall

Smithson's Gift (runs indefinitely) Display celebrating the Smithsonian's 150th anniversary tells the story of the British scientist whose bequest founded the Institution.

Freer Gallery of Art

Crosscurrents in Chinese and Islamic Ceramics (opens February 3) Exhibition of objects, primarily from the 14th and 15th centuries, explores the stylistic influences that resulted from trade between China and the Near East.

Choice Spirits (February 24-August 1997) Works by American tonalist painters Thomas Dewing and Dwight Tryon illustrate the nature of estheticism in the United States at the turn of the century.

Arthur M. Sackler Gallery
Goyō: Japanese Prints (through March 17) Color woodblock prints by Hashiguchi Goyō (issued from 1915 to 1920) are predominantly portraits of women.
Painted Prayers (through April 7) Photographs by Stephen P. Huyler document ritual paintings executed by Indian women on the walls of their homes.

National Museum of African Art
Three Explorations: Yoruba, Temne, and Baga (through February 25) Exhibit examines three recent acquisitions—a Yoruba mask, a Temne female figure and a Baga ritual object.
The Ancient Nubian City of Kerma, 2500-1500 B.C. (runs indefinitely) Exhibition celebrates Kerma, the oldest city in Africa outside Egypt to be excavated.

Hirshhorn Museum & Sculpture Garden
George Baselitz (February 15-May 5) Retrospective of the work of the German Neo-Expressionist features paintings and sculptures.
Directions—Carmen Lomas Garza (through February 18) Works by the San Francisco-based artist present powerful visual narratives of Mexican-American life.

Arts and Industries Building
Equal Rights and Justice (through March 3) Exhibit presented by the Smithsonian's Center for African American History and Culture features contemporary art inspired by the civil rights movement.
Discovery Theater
Silver Winged Wishes and the Golden Memory Box (through March 1) *Music and the Underground Railroad* (February 26-March 7) For information, showtimes, ticket prices and reservations, call (202) 357-1500 (voice or TTY).

Anacostia Museum
Southern City, National Ambition: The Growth of Early Washington, D.C., 1800-1860 (through March 3) A joint presentation with the Octagon Museum, the exhibit includes artifacts, drawings and manuscripts from the early history of the District of Columbia.

Heye Center, National Museum of the American Indian (New York)
This Path We Travel: Celebrations of Contemporary Native American Creativity (through April 8) Unique collaboration features the talents of 15 contemporary Native American artists.

Cooper-Hewitt, National Design Museum (New York)
Gallery Closing The exhibition galleries of the museum are closed to the public for renovation until September. Selected exhibitions will be held off-premises during this period.
Six Bridges: The Making of the New York Megalopolis (through April 19) On display at the PaineWebber Art Gallery, 1285 Avenue of the Americas, the exhibit examines the impact of six major bridges built between 1927 and 1964.

Exhibition Catalogs

Catalogs available currently include:
Metropolitan Lives: The Ashcan Artists and Their New York ($50/$35 paper)
America's Smithsonian ($45/$24.95 paper)
George Baselitz ($65/$39.95 paper)
Itchiku Tsujigahana ($39.95 paper)
This Path We Travel: Celebrations of Contemporary Native American Creativity ($18.95 paper)
To order, send check or money order to Smithsonian Museum Shops, P.O. Box 1140, Newington, Virginia 22122. Include 15 percent of purchase to cover postage, handling (minimum, $4.50).

Smithsonian on the Air

Black Radio: Telling It Like It Was An unprecedented documentary about radio and the 20th-century transformation of the African-American community, hosted by Lou Rawls. Check local public radio listings.
Jazz Smithsonian The legacy of classic jazz comes alive in performances by the Smithsonian Jazz Masterworks Orchestra. Check local public radio listings.

Smithsonian Institution Traveling Exhibition Service

SITES organizes and circulates exhibitions to cities throughout the United States and abroad. To sponsor a show in your community, write SITES, Smithsonian, Washington, D.C. 20560. Here are some February exhibits:
- Abingdon, Virginia (through March 10) *Full Deck Art Quilts*, William King Regional Art Center.
- Frostburg, Maryland (through March 24) *Whispered Silences: Japanese American Detention Camps, Fifty Years Later*, Frostburg State University.
- Imperial, California (February 24-March 13) *Africa's Legacy in Mexico: Photographs by Tony Gleaton*, 45th District Agricultural Association.

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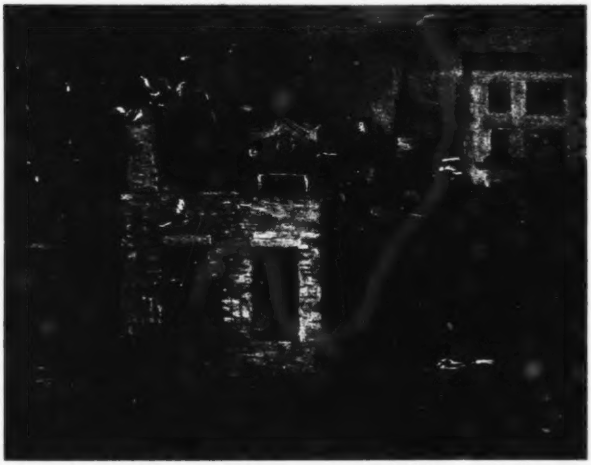
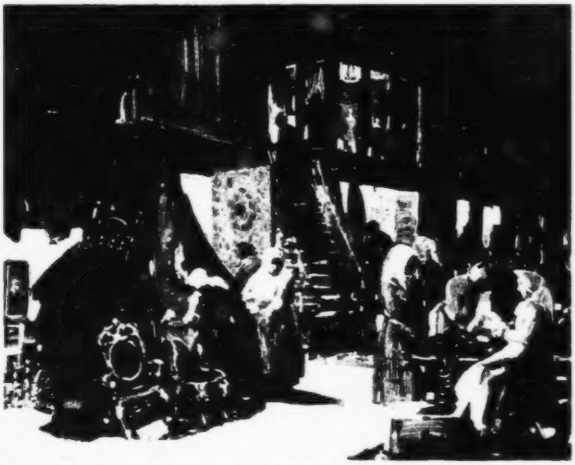
The Ashcan artists take on New York

A fire rages on 24th Street, bright lights illuminate a Broadway stage, pushcart peddlers market their wares, a horse bolts across a steaming street. These scenes from everyday life in New York City at the turn of the century were produced by a group of artists who came to the booming city to create art rooted in the "real life" of their time. From 1897 to 1917, in paintings and graphic works of power and wit, artists George Bellows, William Glackens, Robert Henri, George Luks, Everett Shinn and John Sloan framed a contemporary realism that explored the drama, humor and exoticism of life in the turbulent metropolis. Their distinctive vision captured the energy of the city's streets and squares, and chronicled the dynamic social changes taking place as cobblestones and churches gave way to subways and skyscrapers. From horse-drawn wagons to motorized trolleys, from Fifth Avenue mansions to the teeming tenements of the Lower East Side, they caught the pulse of a city in transition.

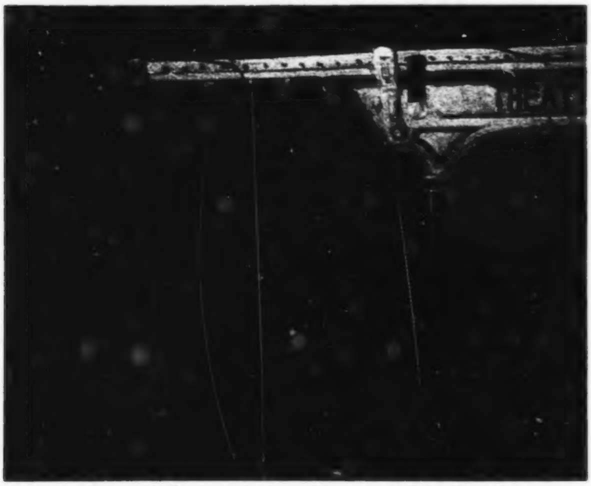
These iconographic works are now in a landmark exhibition entitled "Metropolitan Lives: The Ashcan Artists and Their New York" at the National Museum of American Art through March 17. "From the time they arrived in New York until World War I, the Ashcan artists defined the nuances of a city in flux," says NMAA director Elizabeth Broun. "In these masterpieces they caught the high spirits of a city and an age when everything seemed possible."
Diane M. Bolz



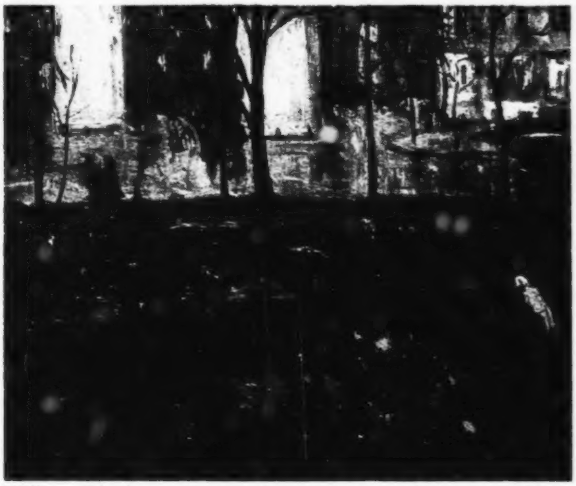
Lit by the slanting rays of the sun, a man and boy race pigeons from a tenement rooftop in John Sloan's *Pigeons* (1910).



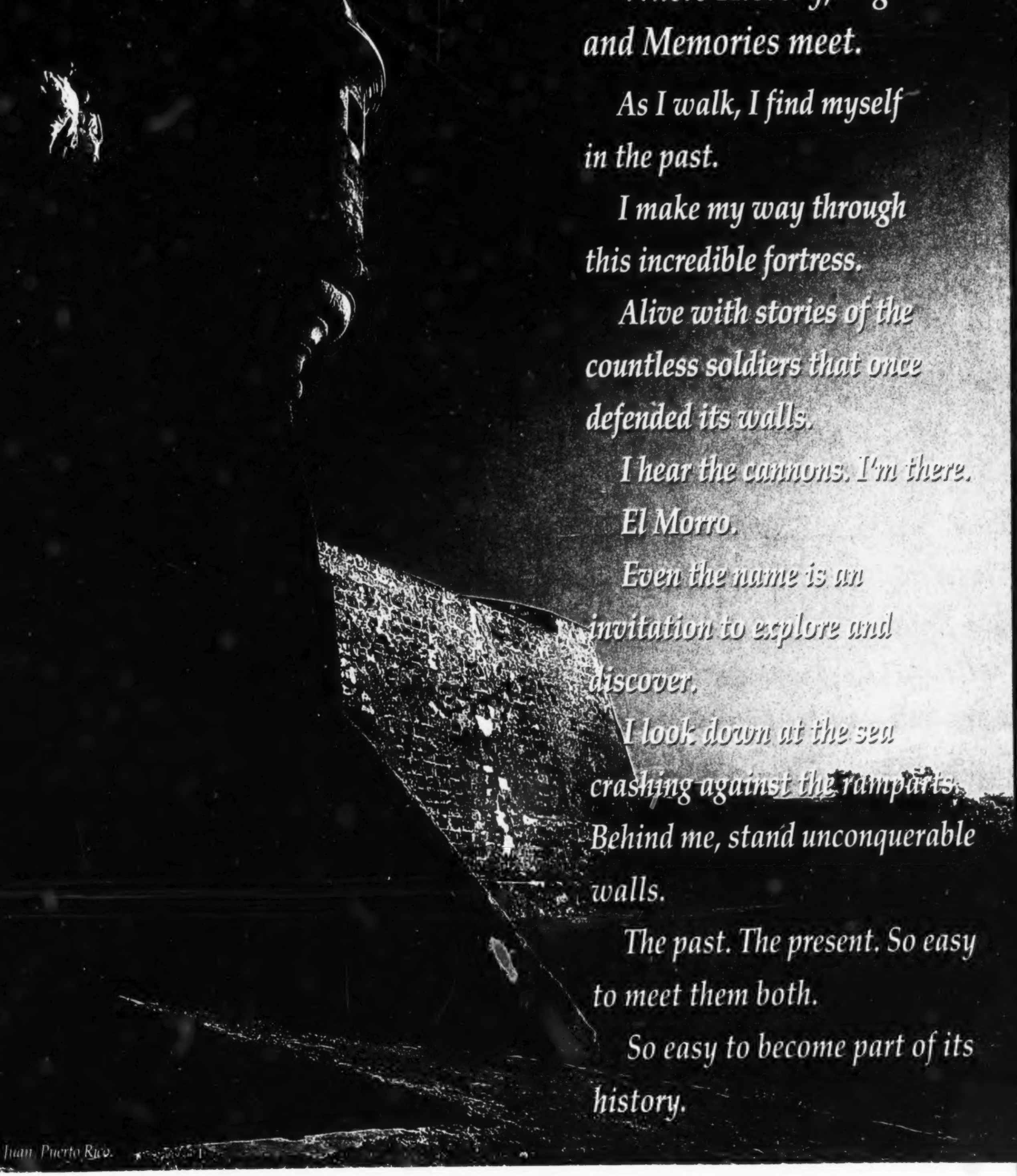
George Luks renders a nighttime scene of Lower East Side shoppers on Allen Street as a lively mosaic of rich color.



Many early movie houses in immigrant neighborhoods were simply informal storefronts, as in *Carmine Theatre* by Sloan.



William Glackens pictures the passing parade in a popular New York park in *March Day—Washington Square* (1912).



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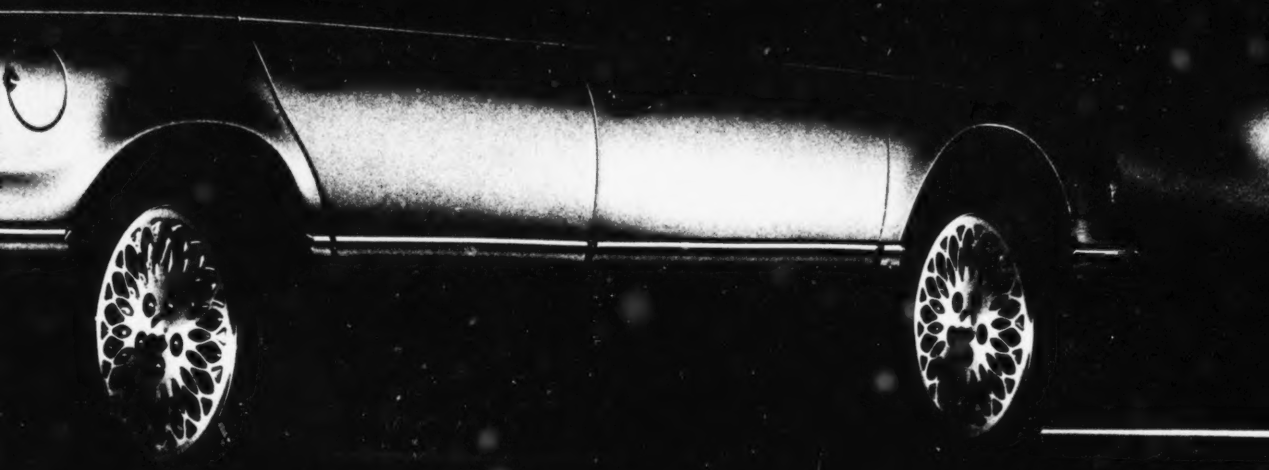

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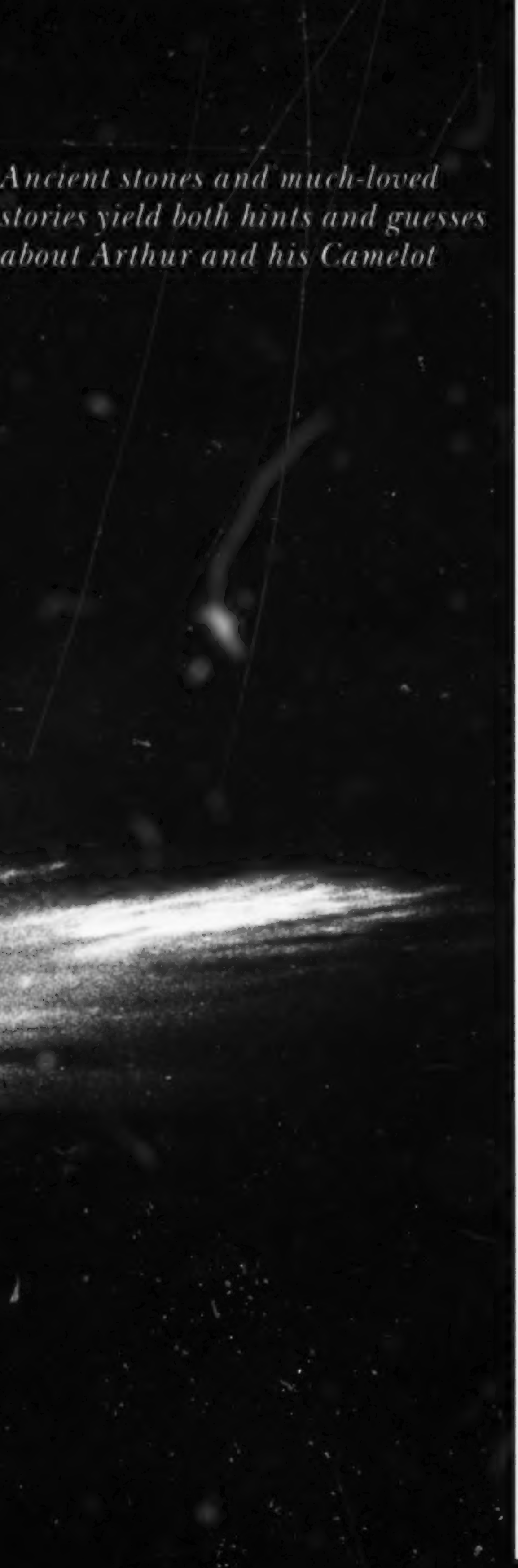
By Caroline Alexander

A pilgrim's search for relics of the once and future king



Ancient stones and much-loved stories yield both hints and guesses about Arthur and his Camelot

Hidden in a thicket, I drew my coat around me and peered into the darkness. It was Christmas Eve. The night was clear and still and without moonlight. I had positioned myself beside a muddy bridle path that winds down a hill between the trees and was quietly awaiting the thunder of hoofbeats. The hill behind me is known as Cadbury Castle, for centuries regarded as the most likely site of King Arthur's Camelot. According to legend, on Christmas Eve the ghosts of Arthur and his knights gallop out of the castle's fallen gates on silver-footed horses.

Cadbury Castle is in Somerset just outside the village of South Cadbury, in southwest England. In daylight, the open grassy summit is brilliant green, rising above an encircling band of forest. From the top, you can look down on flocks grazing the clipped pasturage at the base of the hill. Northward lies the whole width of Glastonbury plain. The first recorded identification of Cadbury Castle as Camelot was made by the antiquarian John Leland in 1542. But it wasn't until the 1960s that parts of the hill's many layers of former settlements were finally excavated, revealing that it had been occupied off and on since at least early Neolithic times. More important, ruins from the Arthurian period were well represented, with evidence of former ramparts, a fortified gate-tower and a sizable timber structure thought to have been a great hall.

I had expected to share my vigil on Christmas Eve with any number of other faithful (or gullible) pilgrims. But when I trudged across the frosty fields to my thicket, I was very much alone. The whirring wings of a disturbed wood pigeon made the only sound I heard all night. At last I reluctantly gave up my post and trudged back down through the fields. The once and future king had failed to appear.

How to account for the spell that Camelot has cast over the world's imagination? In scores of languages and shaped to all sorts of storytelling genres, from medieval epic to modern musical, tales of Arthur and his knights have been enthralling people for more than a thousand years. On plot alone, the legend is hard to resist: the undistinguished boy, Arthur, pulling the sword from the stone to become king of England; his marriage to beautiful Guinevere; the brotherhood of the chivalrous Round Table knights; the quest for that elusive object, the Holy Grail; the disastrous passion between Lancelot and the queen; evil Mordred's treachery; the ultimate destruction of Arthur's realm; the banishment of loyalty, piety and righteousness from the land.

But the emotional pull of Camelot is greater than its

The ruins of a hill-fort known as Cadbury Castle have long been viewed as the likeliest site of Camelot.

Photographs by Michael Freeman

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captivating storybook romance. Arthur's loss of his Round Table, though set in the worldly realm of kings and counselors, jousting tourneys, swashbuckling knights and bewitching ladies, is a replay of mankind's fall from grace in the Garden of Eden. It ends in treason and civil war, with brother against brother, father against son. It has become part of the geography of our collective imagination. Today, that "fleeting wisp of glory called Camelot" stirs an overwhelming sense of loss—a nostalgic yearning for a better-ordered and more-spiritual age that we long to believe once existed.

A magic world of profound melancholy

I have spent years more or less in thrall to the Camelot story. Walt Disney's film *The Sword in the Stone* set me on the path, imparting beyond the comedy and magic a sense of something grave and wondrously tragic. Based on T. H. White's *The Once and Future King*, it opened up Arthur's whole life and world, a medieval land full of hawking and archery and imagined fighting described in whimsical detail yet marked by overwhelming melancholy. Later, Thomas Malory's unwieldy but masterful epic poem *Le Morte d'Arthur* worked for me at a more profound level of regret and grown-up loss, its archaic language evoking images of armored footsteps receding down deserted flinty halls. But it was through Tennyson's epic *Idylls of the King* that all the "Arthurian" emotions—loyalty and loss and the impotent regret of wisdom learned too late—became entirely personal.

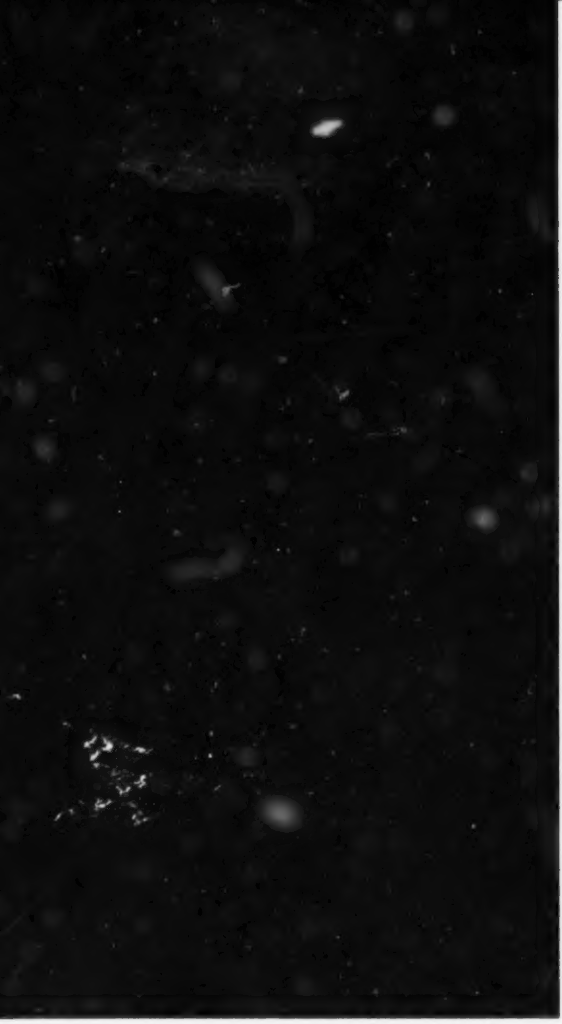
Like many pilgrims, then, I had come to England hoping to find something that might allow me to believe that Camelot was "real." And indeed, the West Country of England is shaped by Arthurian associations. At Tintagel, where Arthur supposedly was conceived, a ruined castle still clings to the dark, sea-beaten cliffs guarding the Cornish coast. A few miles inland, on the willow-fringed banks of the unprepossessing river Camel, is Slaughter Bridge, a village so nondescript that I drove right through it before realizing it is supposed to be the site of the Battle of Camlann, where Arthur and Mordred meet in mortal combat.

From here, so the story goes, the grievously wounded king was carried inland by faithful Sir Bedivere to the heart of brooding Bodmin Moor. One evening I walked the moor toward a pond called Dozmary Pool, near whose waters Arthur's wounded body was laid and into which he thrice commanded the reluctant Bedivere to hurl his sword, Excalibur. Reflecting an evening of vivid sunset, the pool's shallow waters turned blood red. Perhaps it was after seeing such an apocalyptic sight that Tennyson described an astonishing arm: "Clothed in white samite, mystic, wonderful," rising from the water to catch, to thrice brandish and finally sink forever beneath its surface with the world's most famous sword.

Tintagel Castle, on the rugged coast of Cornwall, was named by Geoffrey of Monmouth as Arthur's birthplace.

A hundred miles or so west from Dozmary Pool in the town of Amesbury, I visited a pretty cruciform church where the repentant Guinevere is said to have retreated to the spacious grounds of an early abbey, now a ruin. A pub and some shops have claimed a good deal of the old abbey land, but behind the church is a gently flowing river where a black swan stretched its neck among a crowd of ducks.

Arthur, an old soldier after all, never really dies but fades away—to the enchanted Isle of Avalon, which, since the late 12th century, has been associated with Glastonbury. The extraordinary hill, known as Glastonbury Tor, that juts abruptly from the plain just outside the modern town was formerly surrounded by marsh and may once have had the appearance of a misty, enchanted island. In 1191, the grave of Arthur and his queen was "discovered" in Glastonbury Abbey—a find



Excavations dating ruins here to the fifth century A.D. have lately lent somewhat more substance to the claim.

that launched a lucrative pilgrimage industry and enabled the canny monks to rebuild their abbey, which had burned to the ground in 1184.

In each of these places I caught a glimpse of the kind of romantic "truth" I was seeking. Amesbury was the most evocative, perhaps because it was so easy to imagine the grieving queen pacing the riverbank on a winter's morning, or perhaps because for me the end of Camelot, especially in *Idylls of the King*, has always been most irrevocably signaled by the final parting between Arthur and Guinevere. In the end, however, all these towns and castles failed me. In part this was due to modern realities, such as the King Arthur tourist shops dominating Tintagel, that kept crowding my vision. In larger part, though, it was because I knew before I arrived that the few historical facts known about Arthur cannot be squared with any of these places.

The shadowy figure who became the Arthur of legend first appeared, if he appeared at all, not in medieval England but in the afterglow of the Roman occupation of Britain. The native Britons were "Celts" (SMITHSONIAN, May 1993)—a term used to define a linguistic and cultural group rather than a race. But from Emperor Claudius' invasion in A.D. 43 until the departure of the last legions in 410, Roman culture shaped the island. From the late fourth century on, Roman garrisons in Britain were reduced in order to strengthen the waning empire on the continent then being overrun by Germanic tribes. It is unclear how rapidly the social fabric created by the long Roman occupation unraveled in Britain after the Romans' departure. With the central government gone, local authority was fought over by powerful local rivals. From the 430s onward, fierce Angles and Saxons, intent on making settlements of their own, streamed across the North Sea into the east and south of Britain. In the north of Britain, skirmishes with Picts and Scots, old enemies, were renewed. In response to this last threat, the Britons made a fatal mistake: they hired Angles and Saxons as mercenaries. Sometime around 450, these paid allies turned against their British hosts, and the south and east of Britain fell entirely under Anglo-Saxon rule.

The only surviving near-contemporary account of this period, by a West Country monk named Gildas, reports that these invaders pursued a "scorched-earth" policy: fire "burned almost the whole surface of the island and was licking the western ocean with its fierce red tongue." In the still-unconquered west, Anglo-Saxon and British forces fought a series of battles, culminating, sometime around 500, in a decisive victory for the British at a place called Mons Badonicus, or Badon Hill. The Briton responsible for this landmark victory, as we are told by the very few extant documents pertaining to the period, was a warrior called Arthur.

Badon Hill has been cautiously identified as a long, barrow-shaped hill-fort called Liddington Castle in the Thames Valley, north of Salisbury Plain in a region full of ancient earthworks, stone circles and other prehistoric enigmas. Now in pursuit of history rather than legend, I clambered up its rain-slick slopes on a blustering winter's day, crossed the moatlike ditch that once defended the summit and stumbled upon a herd of grazing cows. A valuable tactical lesson: clearly a squadron of cavalry could have occupied Badon Hill and gone undetected from below.

The victory at Badon Hill temporarily halted the Saxon progress in the Thames Valley and bought the British in this region some 40 years of respite. Nothing

The author published The Way to Xanadu *in 1994. Her latest book,* Battles' End: a Seminole Football Team Revisited, *has just been released by Knopf.*

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much is known about the battle, but general knowledge of military practices of the period suggests that Arthur's men fought from horseback, making repeated passes at the enemy, rather than in a unified cavalry charge. Spears, javelins and long-bladed Roman cavalry swords were the weapons of choice. Most warriors carried oval or round whitewashed shields. A warrior chief of Arthur's standing probably wore battle dress modeled on that of a high-ranking Roman general: a knee-length leather tunic, perhaps with leather breeches and rudimentary armor.

In general, though, the sum of our knowledge about Arthur (or Artorius, his probable Roman name) is that he fought 13 battles, 12 victorious and one mortal, the great majority of which are associated with now unidentifiable places. The earliest account, Gildas' *The Ruin and Conquest of Britain*, dating between A.D. 530 and 540, describes the battle of Badon Hill, but it does not make a single mention of Arthur. His name first makes its appearance about three centuries later in *History of the Britons*, a sometimes specious historical miscellany attributed to a man named Nennius who states, matter-of-factly, that "Arthur fought against [the Saxons] in those days with the kings of the Britons, but he himself was leader of battles." A dozen successful campaigns are then listed, concluding with Badon Hill.

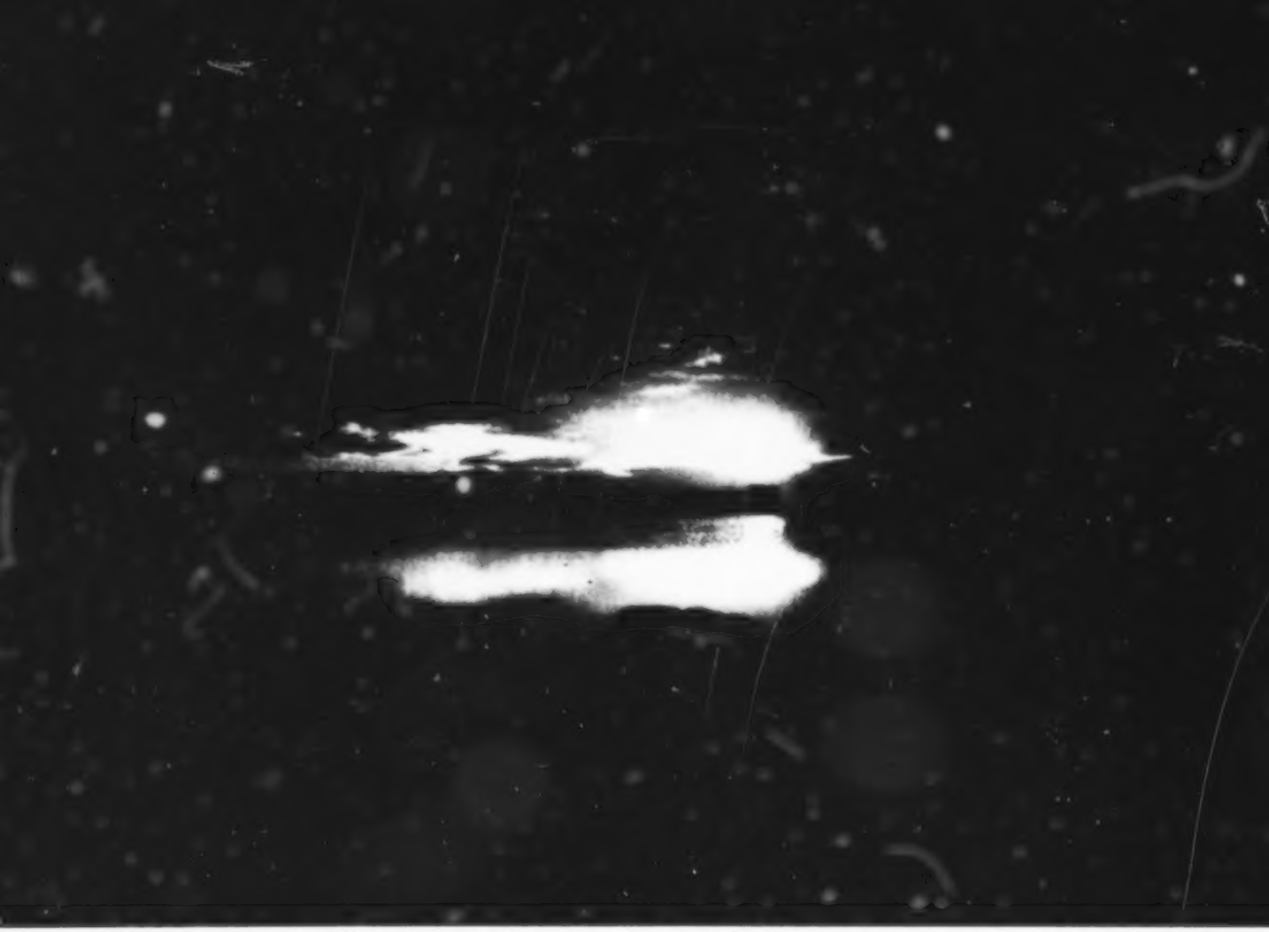
The most exciting source is *The Annales Cambriae*, a manuscript kept in the British Museum. Beginning in an unspecified year, apparently about A.D. 450, it contains sequentially numbered years next to which significant events are recorded. Gently turning its thick parchment pages, I read the following Latin entries: "Year 72. Battle of Badon in which Arthur carried the cross of Our Lord Jesus Christ on his shoulders [on his shield] for three days and nights and the Britons were victorious." "Year 93. The battle at Camlann in which Arthur and Medraut were killed." These brief lines preserve something of the later legend: the Christian warrior-king in a final showdown with the treacherous knight Mordred. Although the chronological format inspires confidence, the annals were in fact compiled about 500 years later from material preserved in monastic records. Even so, nothing in the intrinsic nature of the annals warrants their being dismissed out of hand. The surest facts about Arthur, then, seem to be the sites of his greatest victory and his death.

Despite fierce British resistance in the west, the Anglo-Saxon conquest and appropriation of Britain rolled on. Many Celts fled overseas to kinsmen in what is now Brittany (then called Amorica) or to Wales or Cornwall, which held out against the Anglo-Saxon invaders until 848. The Domesday Book (SMITHSONIAN, July 1986), commissioned by William the Conqueror in 1086, suggests that the population of the island at the time was less than half what it had been under the Romans, an eloquent indication that British displacement had been drastic. Some Britons, of course, had to remain, but the fact that the Old English word characterizing them—*Wealh* (Welshman, Briton)—came to mean "slave" says a good deal about their condition.

So much for historic Arthur. What of archaeological Camelot, the court and headquarters of the legendary king? The 1966-70 excavators of Cadbury Castle discovered remains of earthworks and defenses dating to the critical Arthurian period. Combining features typical of both Roman and British fortifications at the time, they greatly strengthened the site's centuries-old identification with Camelot. Excavations at other sites, however, showed that repossession of Iron Age hill-forts in the fifth century A.D. was common all over southwest England—so there is nothing conclusive about Cadbury's archaeological record. In all likelihood the identification with Camelot arose from the evocative names of the nearby villages: Queen Camel and West Camel.

Nonetheless, the whereabouts and, perhaps more important, the character of the warrior-hero's headquarters were issues that early Welsh bards who embroidered on the Arthur story had to address. And the only truly imposing structures they had by way of models were those built and left by the Romans. The luxurious villas with atrium gardens, central heating, running water and mosaic floors; the great towns at Colchester, Silchester, Wroxeter, with public baths, basilicas, temples, theaters, marketplaces and forums; the ubiquitous

Forlorn Queen Guinevere took refuge in an abbey said to be on the grounds of this church in Amesbury.



Dozmary Pool in Bodmin Moor is popularly seen as the lake into which Sir Bedivere threw Arthur's great sword, Excalibur, only to behold a mysterious arm rise from the water, catch it by the hilt and disappear.

self-contained fortresses: to later generations these must have seemed the stuff of dreams. That even the conquering Anglo-Saxons were not insensible to these monuments of past glory is evident from an eighth-century Anglo-Saxon poem, "The Ruin": "Bright were its palaces, its many bathing-halls, / Its wealth of tall pinnacles, its tumult of warriors, / Many a mead-hall filled with festive life, / Until mighty fate overturned all."

And if resonant for the Anglo-Saxons, how much more so for the Britons, for whom such relics had once been part of a life now all but destroyed. To many Romano-Britons, the fragmentation of Roman order must have indeed signaled the arrival of a dark age, the banishment of loyalty, piety and righteousness from the land; perhaps it is their centuries-old nostalgic despair that finds its voice in the legend of Camelot.

One raw day I took a look at the remains of Viroconium, once the fourth-largest city in Roman Britain, now lying outside the village of Wroxeter in Shropshire. The fog was so thick that even the great brick wall of the town's old baths, the most intact relic, vanished from sight at a distance of 20 feet. Spiderwebs spanning the plum-colored masonry had frozen into rigid lacework. The fallen walls looked like so many piles of rubble but, as I realized when I touched them, were stoutly rooted in their position for all eternity—truly Roman handiwork. Remarkably, after several centuries of decline, this town underwent reconstruction until as late as the end of the fifth century and was apparently used in some capacity until the mid-seventh, thus overlapping Arthur's lifetime. Anglo-Saxon and Briton alike would not see anything to match it for centuries to come. It is reasonable to think that the memory of such unimaginable splendor sparked the earliest description of Arthur's court; if so, Camelot was, in fact, a Roman town.

Ultimately, though, it is not from any pieced-together history or Arthurian tourist sites but from literature, from the magic of storytelling, that what we mean by "Camelot" seems most real. Some glamour now lost to us, some ineffable charisma must have clung to the historical war hero Arthur, slipping through the cracks of the bare surviving facts, because Welsh legends about

Famed Round Table in Winchester Castle bears Arthur's portrait and names 24 knights but was made in the 1200s.

him began appearing in the ninth century and were doubtless sung as early as the late sixth century.

From the great mass of romancing about the king of Camelot, the works of two authors stand out, one British and one French. The first, Geoffrey of Monmouth's *The History of the Kings of Britain*, written in Latin and completed in 1136, became an international best-seller. Geoffrey combined all the loose-ended and free-floating Arthurian lore up to his time, producing a coherent if improbable narrative suffused with Celtic glamour and unfolded against an otherworldly backdrop of dragons, wizards, visions and prophecies. The familiar outline is laid forth: Merlin's prophecy and Uther Pendragon's deceitful seduction of another man's wife, resulting in the conception of Arthur; the adultery of Guinevere; the final battle between Arthur and Mordred on the river "Camblam"; the wounded king's departure to the mysterious Isle of Avalon.

The authoritative, straightforward tone of Geoffrey's pseudohistory put Arthur on the map, so to speak. But the legend of Arthur was permanently embellished by the unashamedly romantic work of Chrétien de Troyes. A late 12th-century French poet, Chrétien often wrote under the patronage of Marie, Countess of Champagne, so that his series of Arthurian romances reflects the refined and feminized tastes of her court in Troyes. Five romances survive. In often titillating detail they tell of the adventures, both amorous and martial, of various Round Table knights. Feasts, tourneys and assemblages of court are featured—and inordinate attention is paid to the dress of both knights and damsels.

Chrétien was not, as is sometimes claimed, the father of Arthurian romance. Behind him, as behind Geoffrey, lies a rich and virtually lost tradition of singing and storytelling. In Wales, for instance, the increasingly elaborate memory of the British war hero's deeds was kept alive in popular folklore and by professional bards, fragments of whose work survive. On the continent Arthur's fame was spread by Breton bards and minstrels who took the stories and songs of their ancestral hero to aristocratic French courts. For a professional storyteller, the entertainment value afforded by an entire company of colorful, chivalrous knights, many amorously linked with some fair lady, was considerable. The relatively advanced status of women in the French courts meant that feminine tastes and the tradition of courtly love already exercised influence. To this increasingly significant audience the story of King Arthur and his court doubtless afforded welcome relief from the other great poetic themes of the day, the unremitting battles of Charlemagne and Alexander the Great. More than a few of the characteristics of today's paperback romances were insinuated into the Christian warrior-king's saga.

The evolution of the "Matter of Britain," as the Arthurian romances were called, spans centuries and cultures, absorbing the characteristics of each passing age. Consider the successive renderings of the name of Arthur's sword: in Irish, it is called Caladbolg; in Welsh, Caledvwlch; Latinized in Geoffrey's *History* it comes out Caliburnus; in French it is Calibourc; and finally, in English, Excalibur.

Similar is the development of one quintessential Arthurian theme, the fellowship of the Round Table. The Round Table is first mentioned in a paraphrase of Geoffrey of Monmouth's *History*, written in French verse by the Norman poet Maistre Wace in 1155. According to Wace, Arthur "made the Round Table, of which the Bretons tell so many a tale," as a way of settling a dispute among his knights about the order of precedence of their seating. Subsequent romances have the table variously seating 13 or 250 or 1,600 warriors.

The bond of loyalty between the Germanic lord and his retainers, famous even in Tacitus' day and heroically dramatized in the Anglo-Saxon epic *Beowulf*, also left its mark on the knights of Camelot. From it came the ideal of a brotherhood of aristocratic warriors equal in their service to their lord. In the poems of Chrétien de Troyes, chivalry tended to be measured by a knight's prowess in the coy game of courtly love, but later narratives introduced a religious dimension. In the *Quest for the Holy Grail*, apparently written by a 13th-century Cistercian monk, a new asceticism crept in: for Chrétien, the ideal knight was an ardent but faithful lover of his lady, but the *Grail* saga offers total chastity as an ideal in itself. It is the virgin Galahad, not the adulterous Lancelot, who is the one to actually see the Grail.

No worldly quest for Arthur is complete without a visit to the medieval Great Hall of Winchester Castle, which, with its cobbled yard and lofty tie-beamed roof and solemn doors, is of all places in England most like my vision of Camelot. A 2,400-pound circular oak table measuring some 18 feet in diameter hangs on one of the flint-and-rubble walls. On it, a portrait shows Arthur as a white-bearded patriarch surrounded by the names of 24 of his knights. To his left, Galahad holds pride of place in the Siege Perilous, the name of the seat reserved for the most pure and blameless knight: "Sir Mordrede," the traitor, is seated to Arthur's right.

For centuries, the Winchester table was venerated as *the* Round Table. Alas, when it was restored in 1976, carbon dating revealed that far from being a sixth-century artifact, the table had been made between 1250 and 1280, during the reigns of Henry III and Edward I. The painting, it appears, was added in the 16th century, probably at the behest of Henry VIII, to whom the portrait of Arthur bears a more than passing resemblance. The table's prosaic origin illustrates how deeply entrenched in history, as opposed to legend, Arthur had become: Henry VIII clearly saw a political advantage in publicizing his royal "descent" from so famous a king.

Despite its many French refinements, the Camelot story's most memorable versions came from England. Thomas Malory's *Le Morte d'Arthur* was published by William Caxton in 1485. Malory was a Warwickshire soldier-rebel who, as a political prisoner of Edward IV's,

The Annales Cambriae, one of the early documents to mention Arthur, suggests that his last battle may not have been fought in the south of England but here, at a Roman fort site in Cumbria, along Hadrian's Wall.

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whiled away the last of several stints in prison producing his mournful version of King Arthur and his knights. Perhaps it was his sobering experience of contemporary politics that gave Malory his melancholy vision of even the most high-minded government. Shedding the charming, country fairy tales of Chrétien, he concentrated on the fateful triangle of Arthur, Guinevere and Lancelot, and wrote an epic. Malory represents the downfall of each as the result of weakness and conflicting loyalties. Though still picturesque, the quasi-medieval world of Malory's creation is harsh and wintry, fraught with darkness and danger. The stakes Malory's characters play for are fatally high. Lancelot returns from his failed quest for the Grail not glamorously disheveled but mortally harrowed. Guinevere, Lancelot and the strangely passive Arthur are destroyed not by potions and magic spells but by more-insidious and more-deadly foes, the passions of their own humanity.

Malory's work inspired Tennyson, whose *Idylls of the King* (published intermittently between 1859 and 1885) brought Arthur to the affectionate awareness of a broad English public. Having inherited the essentially medieval content of the Arthurian tales, Tennyson gave them their final autumnal coloring. He was a master of the elegiac tone, and it is his own sorrow for Arthur's loss that is the poet's most haunting contribution.

Toward the end of *Idylls of the King*, Arthur pays one last visit to his fallen queen, now doing penance with the nuns at Almesbury. As Guinevere lies repentant at his feet, Arthur bluntly tells her: "Thou hast not made my life so sweet to me, / That I the King should greatly care to live; / For thou hast spoilt the purpose of my life." Yet he cannot keep from wondering aloud, "But how to take last leave of all I loved?"

Powerfully taken by the spell of such a scene, it is hard for a reader to remember that every detail—the misty, vaporous night; the "sad nuns" standing with flaming torches outside the cold walls of the abbey; the golden-haired Guinevere, groveling on the floor; the stern and brokenhearted king in armor; the emotional finality—is utter fiction. None of this ever happened; none of this ever existed. It is a marvel that some mix of collective need and artistic imagination, which over the long and fickle centuries fabricated the legend of Arthur down to the last bright rivet of armor and thread of gold embroidery, had, at the end of the day, integrity enough to preserve the essential truth of irrevocable loss that lies at its deeply buried core.

It is here in the works of these two very different men that I like to feel the real Arthur—the Romano-British Artorius fighting for his life against barbaric forces— at last received a fitting characterization and tribute. Although the victory of Badon Hill bought borrowed time, the overall cause of this obscure warrior was doomed, and whoever he was, he lost a world.

The curt, unadorned style of the references to the Battle of Camlann in *The Annales Cambriae* has convinced many experts that this entry, at least, is genuine. Some scholars believe that Camlann itself may be a late form of Camboglanna, the name of the largest Roman fort built near the western end of Hadrian's Wall (Smithsonian, April 1985), which runs from Newcastle upon Tyne to the Irish Sea. This would place Arthur's last battle not in the Celtic West Country, where legend

In legend, Glastonbury Tor is the Avalon where Arthur supposedly still resides, waiting to return one day.

and logic, as well as Tennyson and others, have placed it, but in the north of Britain, on the Northumbrian border far from where I had originally sought it. Intriguingly, the very few tentatively identifiable battle sites named in Nennius' list of 12 are also in the north. But if it is true, as many believe, that Camboglanna represents the most hard and certain fact in the whole tissue of Arthurian lore, then Arthur did not die fighting his Anglo-Saxon enemies but in an internecine border war with another British faction.

Eventually I walked an outline of fallen stones, all that now remains of Camboglanna. To the east and to the west, the Roman wall—already centuries old by Arthur's time—stretches to the horizon across rolling pasturage, green even in midwinter. Arthur may have died fighting for this fort, or he may have fallen somewhere beyond, in the perpetually green fields. A dramatic loop of the Irthing River flows through a glen below the fort, and it may be that he was finally lost in its swift, dark waters. It says much about the power of the Camelot myth—and my own romantic susceptibility—that even at the end of this quest I continued to believe some tangible proof of its reality had eluded me only because I looked in the wrong places. Now, at what may be the site of that "last, dim, weird battle," I couldn't help but think that if it was ghosts I was after, it was here and not at Cadbury Castle that I should have kept my midnight vigil for the once and future king.

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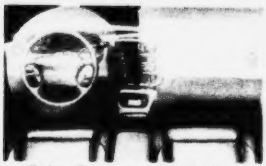

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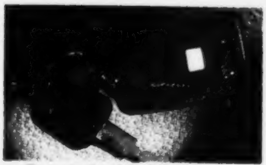

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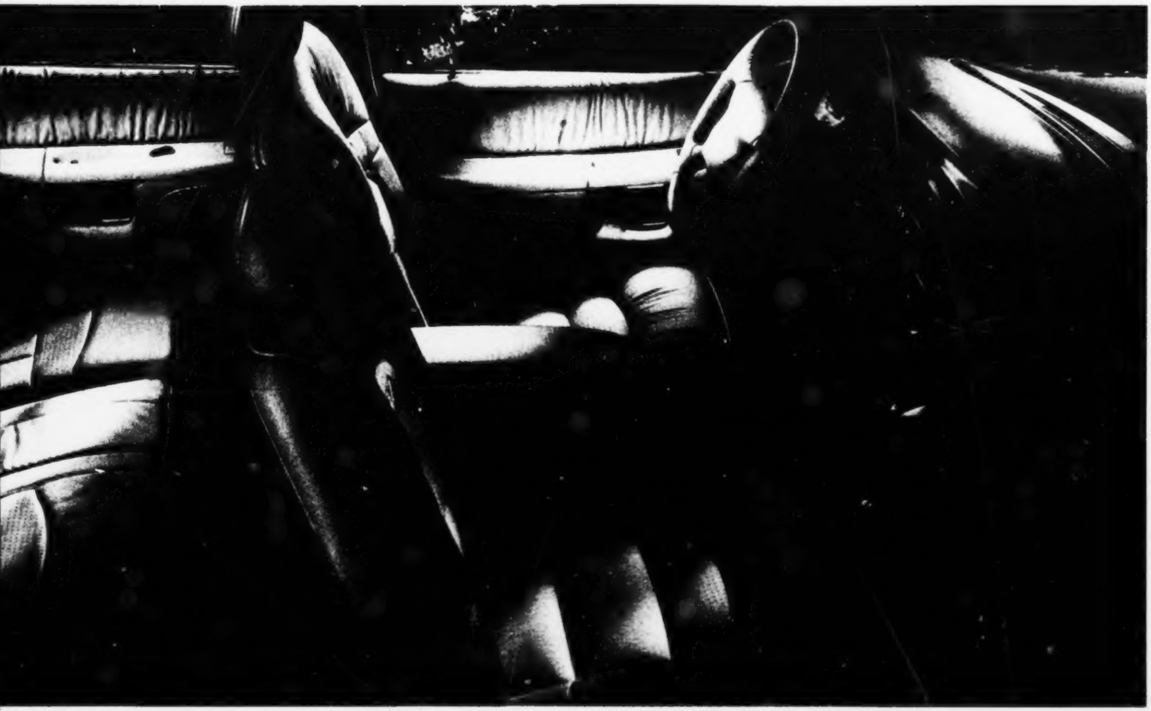

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1590

By Jeannie Ralston

Bark grinders and fly minders tell a tale of Appalachia

At his Tennessee museum, John Rice Irwin's love for his mountain upbringing puts people in touch with a fast-disappearing way of life

Founder-director Irwin, a homemade walking stick in hand, rocks at hearth of Peters Homestead House.

John Rice Irwin opened the door to the weather-beaten smokehouse on the edge of Vaulty Maloney's property and peered in. "There any snakes in here?" he asked the owner. It was a good question. After all, Maloney lives in a ribbon of the East Tennessee Valley known as Snake Hollow. When Maloney assured him it was snake-free, Irwin—neatly dressed in slacks, button-down shirt and black cowboy boots—stepped inside, picking his way over boards and rusted farm equipment. "Look at this!" he exclaimed as he handed out a small wire cage that was used as a muzzle for a calf. Then he sent out a narrow, wafer-thin piece of wood with a pointed top. "That's a work of art," Irwin, the founder and director of the Museum of Appalachia in Norris, Tennessee, said, noting the simplicity of the design of what he identifies as a board for drying animal skins.

Maloney, a gaunt 80-year-old, stood outside the smokehouse with his hands in his pants pockets. As Irwin stacked more boards and some steel traps against the wall, Maloney began talking about the days years ago when he helped to feed his family by trapping. He spoke quickly and with great animation, as if he had practiced the pauses and eyebrow raises on other audiences. His words were sometimes hard to understand because of a thick mountain accent and competition from the droning locust in this midsummer dusk. "One day ah was walkin' here with a coon over my back, and two fellers from Morristown drive by. They yell out, 'Hey, you look like Dan'l Boone!' And ah said, 'Ah oughta cos Ah'm his half-brother.'"

After several more rounds of jovial stories, Maloney sold Irwin 15 of his old skinning boards and several traps. Irwin brought them back to his museum, where he will eventually display them with more than 300,000 other items made and owned by mountain people, from butter churns and bark grinders to tooth pullers and fly minders, items that will document for visitors how Appalachians once lived and worked and played, and will chronicle a way of life that is all but over. For more than 30 years, Irwin has visited hundreds of people like Maloney, acquiring the artifacts displayed in some 30 buildings that sit on 65 well-tended acres at his museum in

Built in the early 1800s, the log dwelling was moved to the museum's Norris, Tennessee, grounds in 1980.

Norris, 16 miles north of Knoxville. An inscription in the museum sums up Irwin's overriding philosophy: "What better way is there to know a people than to study the everyday things they made, used, mended and cherished and cared for with loving hands?"

Last year, about 100,000 people stopped at the museum, most exiting off nearby Interstate 75, a main corridor that snaps together the Midwest and the Deep South. Many of the visitors have already been to the tourist shops of Gatlinburg or Dolly Parton's Dollywood or other attractions that trade in the "hillbilly" stereotype. But what they see at Irwin's Museum of Appalachia is different. It's authentic, it's passionate and it's put together by a man who has lived and loved mountain life.

The name "Appalachia"—a region most closely identified with the mountainous parts of Tennessee, West Virginia, Kentucky, Virginia and North Carolina—evokes many images: coal miners with faces covered in soot, their eyes appearing more weary set against the blackness. Barefoot children in junk-strewn front yards. Moonshine stills and feuding families. Deeply wrinkled old women with gnarled hands bent over quilts. Joyous faces gathered around a front-porch fiddler. Waves of mauve mountain peaks, each range growing successively lighter as the eye moves toward the horizon.

Because of the isolation created by the towering mountains and deep hollows, Appalachia developed as a distinct and idiosyncratic culture. It was one of the last places in the country that passed into the modern era still resembling pioneer life. Families back in the rhododendron-choked woods had to be resilient, scrappy islands to themselves—growing their own food, forging their own horseshoes, cutting their own timber.

From tools to butter, handwork eclipsed

But in the past 20 or 30 years, progress has come to the mountains, and for better or worse, it has replaced that which made life here so difficult yet so romantic. Satellite dishes bring Katie Couric and Bryant Gumbel into many living rooms. No one makes tools or butter anymore; like most Americans, Appalachians now buy hammers at Wal-Mart and margarine at Krogers. Fortunately, John Rice Irwin began his museum when those who lived close to this undulating earth were still alive.

"When I started I didn't have the foresight to think that a way of life that I knew had been in existence for hundreds of years was ending," says Irwin, a handsome man with a shock of white hair. "I didn't realize I was the last of an era. If someone from the 1200s or 1500s was raised from the dead, they would have recognized the way of life I had when I was a child. Then all of a sudden—boom!—it was gone."

As we drove a twisting, two-lane road, Irwin suddenly pulled his van onto the shoulder and pointed at a ramshackle, gray-wood building with a small Coca-Cola sign outside. This was once a thriving country store. "We used to stop here all the time," he said wistfully. "It was so picturesque." Now the store is being swallowed up by a body shop on the property. The area was littered with carcasses of automobiles and motorcycles, piles of car parts and a satellite dish. "That," Irwin said emphatically, "is what has happened to Appalachia."

But Irwin has managed to keep his corner of Appalachia as charming as it once was, and maybe more so. He has moved a number of log structures—mostly homes and cabins, but also a church and a school-

Photographs by Peter Krogh

1592

Irwin travels deep into the backcountry: in a smokehouse (above) he uncovers handhewn trapper's boards, used for drying skins. He acquired figurines from folk artist Troy Webb (right), here with grandson; from old-timer Nealy Price (far right) Irwin bought household implements.

house—from surrounding areas, restored them to their original condition and set most in the woods that form a fringe around a large open meadow. The interiors of the cabins are furnished to feel lived in, "as if the family has just strolled down to the spring to fetch the daily water supply," says Irwin. The meadow, defined by a split-rail cedar fence, offers a tranquil, pastoral vision. An unusual cantilevered barn sits to one side, sheltering hay and an old wagon. Sheep bound across the field, past haystacks that resemble giant brown gumdrops. Peacocks and guinea hens stroll near vegetable gardens filled with greens and corn that needs harvesting. It makes mountain life seem more serene than scratching out an existence here probably ever was.

Touring the museum, the first thing that struck me was the sheer volume of artifacts. In the cavernous display barn alone there are 209 different hammers—cobbler's hammers, horseshoeing hammers, leather hammers. Irwin has also assembled 51 distinctive walking canes, from one carved like a snake to one that has as its handle a fist giving the finger, the traditional attitude of mountaineers toward the outside world.

But beyond the numbers, what distinguishes the museum is that it vividly portrays something ethereal—the soul of mountain people. Items in the display barn seem haphazardly thrown on the walls, with an occasional hand-lettered sign telling a story about the original owner or how Irwin acquired it. The informality makes the place feel more inviting and accessible. "If I had gobs of money I would have nice plaques, but they would be cold," he says. "Now, at least you know a human wrote them." Irwin's dry wit comes through strongly in these placards. For example, in the trapping section, Irwin has put a sign next to a primitive rattrap. A piece of steel is mounted on the wall, with a rock sitting on top of it, and a rope with a corncob on the end hangs down from it. The sign reads: "When rat nibbles corn, trigger is released and rock falls on said rat. Hopefully."

Items at Irwin's museum show mountain improvisation; there is a telescope made from a drainpipe and old headlights. And they speak of hardships faced. Irwin displays several long sticks that were used specifically to smooth the linens on the side of the bed next to a wall. One has a tweezerlike contraption on the end. When Irwin asked the owner what that was for, he was told that if a snake dropped down from the ceiling, she could pick it up and remove it. The pieces also reveal a high standard of workmanship. While standing in the General Bunch House—built in 1898 and the first dwelling moved here—Irwin picks up a wooden high chair and bangs it on the floor. "This high chair was built in 1840," says Irwin. "It has no glue, no nails, but it's so solid. Now, with all the metallurgists and scientists, some chairs won't last more than 15 years. *That* tells a story."

The most impressive exhibits include one on folk art, which features the work of noted mountain characters

such as Minnie Black, who makes people and animals out of knobby gourds, and Troy Webb, 73, a coal miner who concentrated on whittling to fill time after he lost his leg in a mining accident. Irwin discovered Webb 25 years ago. Today the craftsman can't keep up with the demand for his most popular item—a coal miner figurine that resembles a neighbor in Webb's hometown of Clairfield, Tennessee. "Irwin was the first person to buy anything of mine," says Webb, gratefully.

Probably the most renowned of the exhibits is the music section, which is housed in the Hall of Fame, an 18,000-square-foot brick building Irwin recently constructed to hold his ever-expanding collection. Music is an elemental fixture of the region, and Irwin has succeeded in gathering an array of instruments, from the famous to the just plain weird. As with most things, the mountain people employed great ingenuity when creating their own instruments. Irwin displays a guitar made from a commode seat, and banjos made from a ham can, a cookie tin, a hubcap. There's also the mother-of-pearl-inlaid fiddle that country music legend Roy Acuff gave to Irwin one night at Nashville's Grand Old Opry. One of the most imaginative instruments is a fiddle once owned by musician Raymond Fairchild that was made from the jawbone of Fairchild's beloved mule.

"Of all the things made by man, the fiddle probably conjures up more happy memories than anything else," says Irwin, a mandolin player himself who performs with a group called the Museum of Appalachia Band, which includes his wife, Elizabeth, on the spoons. Irwin and his band, as well as a host of other musicians, often play at the museum, particularly at the two main festivals—Fourth of July and Fall Homecoming, a four-day event in October that last year attracted 40,000 people.

On the Fourth, the grounds were filled with the sounds of fiddles, banjos and Jew's harps, producing a stirring soundtrack for the visual pageant. From inside the small log church in the woods known as Irwin's Chapel came the soaring harmonies of hymns being sung by a choir. The scene was so engaging, the singing so welcoming, that many visitors sat down on the log benches, picked up hymnals and joined in.

The Fourth celebration was topped off by a traditional form of mountain merriment that Irwin has resurrected—an anvil shoot. One anvil is placed on top of another with gunpowder in between them, and when the gunpowder is ignited the top anvil is shot in the air, sometimes as high as 100 feet. It's a stunning, nerve-shattering experience that's a crude but effective forerunner there of the fireworks that are popular today. An 83-year-old visitor at this past Fourth celebration had traveled from Georgia simply because one of the three

Author Jeannie Ralston, who grew up in Kingsport, Tennessee, and lives in Texas hill country, says this article took her back to her Appalachian origins.

things he wanted to see before he died was the anvil shoot. "I remember my dad used to shoot one off in the summertime," Frank Evans said, after he excitedly watched the anvil somersault through the sky. "I love it here," he added with a sigh. "It's like coming home."

Responses like Evans' warm Irwin's heart. His goal is to make the museum seem real: to him that means presenting all aspects of life here, the good and the bad. Irwin, who has a degree in economics and history, tries to approach his subject with a historian's straightforwardness. He is as willing to commemorate the moonshining, trigger-happy Snuffy Smith types as he is Cordell Hull, a native son who grew up to become FDR's Secretary of State. To remind visitors that not all mountaineers were noble, Irwin has moved some bleak iron jail cells from the 1870s to the museum grounds.

Though he attempts to be objective, it is impossible for Irwin to hide his ardor for the place and his personal connections. Many cabins contain pieces from his own boyhood. Amid homey tableaus of split-bottom chairs, dough trays and pottery in the McClung House—which dates back to the late 1700s—sits a wardrobe from a room Irwin used to sleep in; included in a Hall of Fame exhibit is a toy wagon his grandfather made for him while they sat before a fire on a snowy day; in the Peters Homestead—a two-story cabin built in the early 1800s—is a cupboard Irwin used to break into as a boy to steal his grandmother's homemade sweets.

Irwin's roots here run deep. Nicholas Gibbs, one of the first settlers in this part of the state, was Irwin's great-great-great-great-grandfather. Irwin grew up on several different farms in the area. His family was moved once to make way for a Tennessee Valley Authority project, then again during World War II to make way for the nuclear facility in Oak Ridge. The homes he shared with his father—a farmer—his mother and one younger brother had no electricity, no running water, only a wood stove for cooking and a fireplace for heat. He remembers on frigid nights his grandmother would heat some bricks in the fire and wrap them in a blanket so he could take them to bed with him. Still, he says, "we never considered ourselves poor."

Though Irwin was a good student, much of his education came from his grandparents. His grandfather Irwin shared with him "the names of every plant, every vine and every tree," he says. From both grandfathers he learned about farming and living off the land during the trying times of the 1930s, and his grandmother Irwin passed on an industriousness that in her tireless grandson seems to have grown into workaholism. His grandfather Rice started Irwin's collecting habit by giving him some items that belonged to his own grandfather, a gunmaker, and to his great-grandfather, a corn miller. Irwin's grandfather also made a prophetic suggestion. "When I expressed an interest in old planing tools or this or that," Irwin recalls, "he'd give me a little something. The word 'museum' was hardly in his vocabulary, but I do remember very distinctly that he said, 'You ought to keep these old-timey things that belonged to our people and start you a little museum sometime.'"

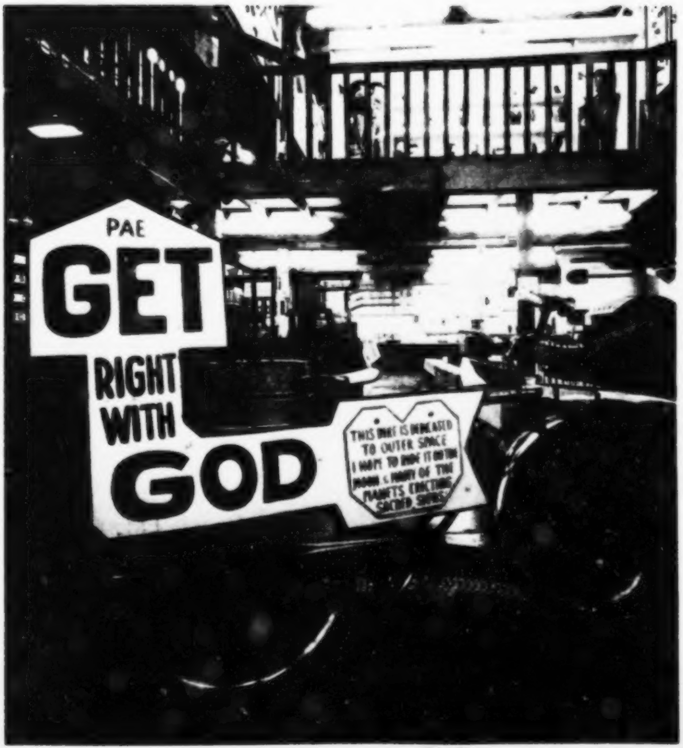
The road to snatching treasures from oblivion

It seems natural then, that Irwin pursued history in college. Later, when he was considering the Foreign Service, he got a master's degree in political science that focused on international law. His thesis, ironically enough, was on the divided states of Yugoslavia, and he dreamed of a romantic life traveling around the world. Instead, Irwin stayed at home and became a teacher and later a principal. And in 1962, at the age of 31, he was named head of Anderson County's schools, becoming the youngest superintendent in the state.

In the early 1960s, Irwin began moving from formal education to what might be called one long field trip into Appalachian history. His interest in serious collecting was sparked by the auction at his neighbor Charlie Miller's place. "I remember that there were all these things that were historically significant being sold. The treasures from several generations of the Miller family had been carried from the old two-story home, from the smokehouse, the corncrib, and from the barn. Pictures of family members, whom no one could now recognize, lay next to old spinning wheels and bread trays."

Irwin remembers being galled by a comment he overheard. A couple from the North was planning to make a lamp out of an old butter churn. Then, to make matters worse, the auctioneer offered a small blue horseshoeing box and casually mentioned that it had survived what was known as the Barren Creek Flood. Irwin knew that this flood was one of the most devastating events in the area's history. In 1917 it had washed away a whole hol-

Everyday artifacts, including a collection of saws (above, left) grace Display Building walls. That space also contains eccentric offerings such as an itinerant evangelist's bike (right). Jewel-studded vintage acoustic guitar is housed in Hall of Fame.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THIS BIKE IS DEDICATED
TO OUTER SPACE
I HOPE TO RIDE IT ON THE
MOON & MANY OF THE
PLANETS ERECTING
SACRED SIGNS

Companionably snapping beans, two sunbonneted women chat with Irwin during the Fourth of July fest.

Independence Day gala attracts scores of musicians; guitarists Otha and Stanley Emert strum a duet.

low, killing nearly 20 people and scores of livestock. The horseshoeing box had been fished out of the river 50 miles downstream. He was disheartened that no one else seemed to note the piece's striking provenance.

Irwin decided he had to have the horseshoeing box, not because it was much to look at, but because it embodied a moment, a tragedy; it connected past to present, and it prompted an epiphany of sorts. "I got to thinking that these items don't mean anything if you don't know who made them and cared for them." After this auction, Irwin became a man with a mission, which led to a new life—one where he was on the road every moment he wasn't at his day job. Weekends and holidays were spent visiting families, rescuing pieces from trash heaps and smokehouses before rot or antiques dealers could claim them.

At the time he started buying, Irwin was supporting his wife and two young daughters on a salary of $2,700 a year. Fortunately, artifacts were not expensive at this time; nonetheless, his new avocation caused tensions. "I thought he was crazy," says Elizabeth, his wife of 40 years. "For 10 or 12 years in a row, he was never home on Thanksgiving. There was a lot of anger and resentment." Now, however, Elizabeth is an avid supporter of Irwin's work and coordinates special events at the museum.

His collection (in the early stages, made up mainly of pioneer tools) grew quickly, and so did his reputation. In 1965 his pieces were stored in one long building on two acres in Norris. In 1968 he had moved some old cabins to his property and began charging 50 cents to let people go through them. "We didn't plan on opening it up at all, but people were coming through so often, on the way back from church on Sunday for instance, that we decided to just open it up and charge," he says.

Irwin continued acquiring at a voracious pace. But tracking down artifacts wasn't always easy. Many mountaineers were wary of strangers or reluctant to sell. Irwin has been chased by dogs, mistaken for a local criminal and has had guns stuck in his face. One day he stopped in to see an elderly woman, whom he found sitting on her front porch breaking snap beans. After chatting a bit, he asked if she had any old things she might want to part with. "She didn't say anything. She put her beans down and reached into her apron and pulled out a pistol," he recalls. "She waved it in the air and said, 'You know why I carry this?' and I said, 'I have no idea,' and she said, 'I carry this for these people coming around here bothering me wanting to buy antiques.'"

Irwin didn't buy anything that day, but eventually he returned to purchase a treasure trove of old furniture and handwoven dresses and petticoats made from fabric colored by vegetable dyes. With his knowledge of colloquial names for various plants and his ability to identify arcane farming equipment, Irwin has a knack for winning over even the most cantankerous seller. Recently, after noticing a small aluminum wash pan at the mountain home of 87-year-old Nealy Price, he asked her how much she wanted for it. "I know, but I'm not saying," said the cagey Price, who lives alone in a three-room cabin with no running water and keeps a pistol hanging on a nail over her bed. When Irwin offered five dollars, she responded, "Five dollars is a mighty big price for a

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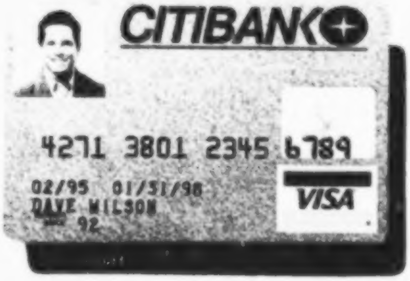
And a boy!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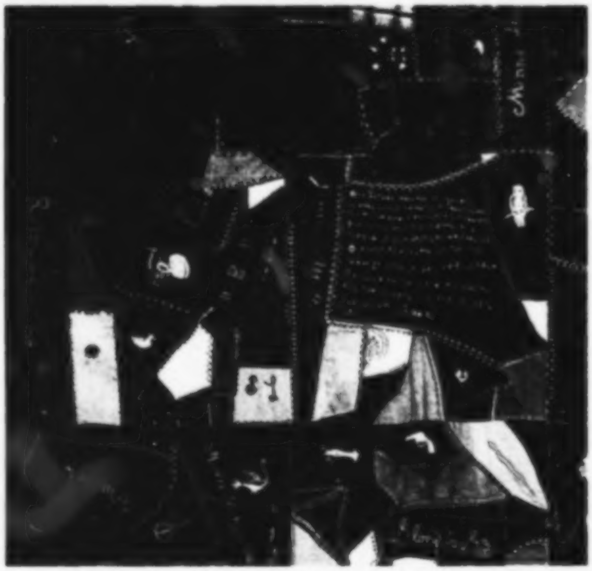


Irwin's most cherished possession, a crazy quilt pieced by his grandmother, takes pride of place in his office.

pan with a hole in it." "Well," Irwin answered with a shrug before pulling out his wallet, "the fellow who wants it has a hole in his head."

Irwin likes people to know he pays fair prices or even higher. And it is important to Irwin that he actually buys the artifacts, versus taking donations. At least 95 percent of the museum pieces were purchased. "I don't like to accept donations. Early on, a fellow gave me a wonderful iron that used charcoal inside, and I displayed it," he says. "One day the guy came back and said, 'I believe I'll take that back, my children want it.'"

By 1980 the museum had grown so large that Irwin quit his job as the director of an education cooperative in order to devote his full time to it. It was large but still relatively obscure. That changed dramatically during the '80s. One person who helped bring national attention to the museum was Alex Haley, the author of *Roots*, whom Irwin befriended in 1982. The two met when they served on a commission to plan the state of Tennessee's bicentennial celebration. Haley was so enchanted by the museum and the surrounding countryside that he bought a farm nearby. Until his death in 1992, Haley was an unflagging fan of the museum, bringing celebrity friends like Oprah Winfrey to visit. These star appearances helped raise the museum's profile and esteem. The museum, which is completely self-sustaining and receives no endowments, has other prominent supporters, including former U.S. Senator Howard Baker—a distant relative of Irwin's—and former Tennessee governor Lamar Alexander, who is running for President.

John Rice Irwin has won his share of recognition as well. In 1989 his work was rewarded with a MacArthur Grant, which provides "extraordinarily talented individuals" with a monetary sum that is paid out over ten years. Irwin has written six books, including one about the quilts of the region, as well as an in-depth profile of a shrewd and talented mountain man named Alex Stewart. Irwin has built such a name for himself that ads in a local magazine promote the place as "John Rice Irwin's Museum of Appalachia."

But the fact that he is so central to the museum's success has a drawback. As the museum has grown, it has been impossible for Irwin to keep up with the work he is uniquely suited to doing: researching the background of artifacts and cataloguing them. The museum employs 40 people—groundskeepers and restaurant and gift shop workers—but no one has the knowledge that Irwin possesses about the pieces he buys. "I'd know somebody to call for information about a piece that came from any county within 100 miles," he says.

For instance, he recently was trying to piece together the background of a Union County doctor whose medical case—containing 56 vials of drugs—he had just bought. "I know all kinds of people in Union County; I know who to call about this case," he says. Thousands of items are awaiting such attention. Walking through one storage area, Irwin seems terribly saddened as he surveys pieces in piles as high as he is. "When I think of each one of these items, I think of the number of trips made to get it, the letters written, the calls made, the planning . . ." he muses. "It becomes an obsession to get all this out on display before I forget. But I realize I'm not going to have time to get everything displayed."

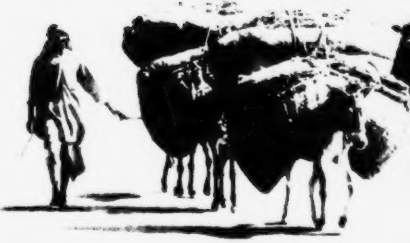
Though his wife and daughter Elaine have pushed him to concentrate on cataloguing items, Irwin can't stop acquiring. "You never know when you open the door to the old building what you'll find," he says with obvious relish. "It's like panning for gold." There's always the chance he is going to stumble on a piece that sheds new light on life here or will stand as a testament to a different element of the mountaineer spirit. He mentions one of his favorite pieces, a crude, flimsy chair made from an orange crate, displayed in the Hall of Fame: "The owner explained this was the only chair he had growing up, and he and his brothers and sisters used to fight over who would sit in it. He said, 'We didn't know anybody who was poorer than we was.' I'd rather have this than a Windsor chair worth $2,000."

Upstairs in his office, which is overflowing with books and items needing tags, Irwin showed me something that might seem pedestrian to the casual observer but is, in fact, his prized possession. It was a crazy quilt, a mélange of solid and plaid fabrics embroidered with various animals and everyday items (above). There was a chicken. A horse. A salamander. A fiddle. A Jew's harp. There were the words "God Bless Our Family." The quilt was made by Irwin's grandmother, who pieced it together at the turn of the century, before she married.

Irwin first laid eyes on the quilt years ago, and until he saw it, he knew nothing of his grandmother's passions or creative talents. "She spent her life helping others. [Relatives] referred to the farm as 'Uncle John Irwin's farm' and the children as 'Uncle John's children,'" he says. "She had put on the quilt all the things she liked. I never knew she cared about art, or that she had an artistic streak. If it were not for the quilt her great-grandkids would only have known her name and that she spent all her time cleaning, cooking, darning socks, ironing—things that wouldn't lend themselves to any kind of perpetuity." In an apparent contradiction to the anonymity of her life, she inscribed a plea on the quilt that Irwin calls "the most dramatic two words I've ever read." They say: "Remember me."

As he smoked a hefty cigar, Irwin studied the quilt for a long, choked moment. "For years, I've wanted this. I've lain awake at night wondering how I could get it without offending the rest of the family." This year, a cousin called and offered to sell it. Now, Irwin is looking for the proper place to display it to serve the quilt's haunting request. "It gives me a good feeling that I'm able to commemorate her," he says with a slight smile that lasts for only a second. "The sad part is there are so many people similar to her who are only remembered by a moss-covered tombstone that says 'Alice Bell: Born such and such. Died such and such.'" But, thanks to Irwin, there are a lot fewer than there would have been.

Interior of the McClung House, built in 1790s, exudes a sense of history from every beam and floorboard; the log structure was moved in pieces from its original site, near Knoxville, Tennessee, to the museum in 1964.



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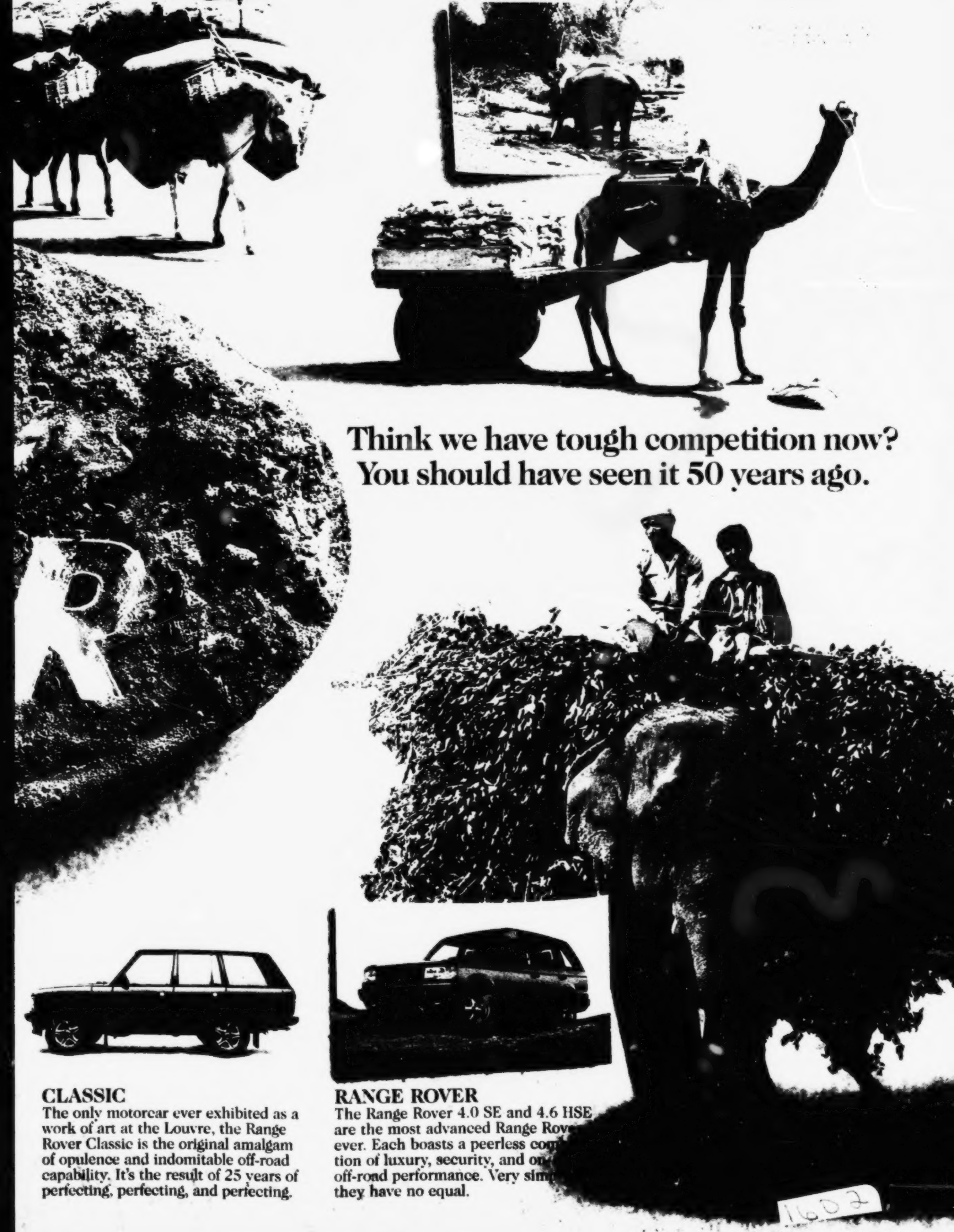

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1602

By Richard Wolkomir

Decibel by decibel, reducing the din to a very dull roar

At RH Lyon Corp, noisebusting engineers tackle everything from leaf blowers to ticking clocks in their search for the right sound

The interrogation is under way. The "prisoner"—an upright vacuum cleaner—stands atop a wooden box. Cords hitch the cleaner to the wall so it cannot move. The inquisitor, an engineer skilled at getting household appliances to reveal their secrets, turns on the juice: the immobilized vacuum cleaner can only scream. It is a caterwaul piercing enough to peel your nerve fibers. And that is precisely the point. Via instruments, the engineer is asking the tied-up vacuum cleaner to confess: Which of your parts makes that obnoxious shriek?

In the end, the vacuum cleaner will spill the beans. They always do, the refrigerators and food blenders and washing machines and electric drills sent here to RH Lyon Corp, in Cambridge, Massachusetts. Manufacturers of these sonically wayward appliances turn them over to the Lyon engineers for acoustic tough love.

Richard H. Lyon, the company's founder, is an MIT professor emeritus. He is the holder of six patents, past president of the Acoustical Society of America and the author of four engineering tomes on acoustics. But in this nondescript building tucked among outermost Cambridge's malls and burgerterias, Lyon vivisects appliances. He and his ten full-time and part-time noisebusters disembowel clothes driers and pull the wires out of leaf blowers. Their business is helping companies like Ford, Raytheon, General Motors, Nissan, General Electric and Xerox to get their products to pipe down. Few manufacturers can do it themselves.

Even megacorporations rarely employ their own acoustics experts, and as one Lyon acoustical engineer puts it, "Decibels just don't mean much to washing machine engineers." Also, trying to trace a clang or a pop-pop or a wheeze to its source can make you crazy.

Richard Lyon, soft-spoken and silver-haired, cites the relatively simple case of the rattly gears. Shortly after he founded the little firm in his suburban basement in 1976, the Singer Company sent him a sewing machine: its gears rattled, but engineers could find nothing wrong with them. Lyon finally traced the noise to the sewing machine's needle. Every time the needle stabbed the fabric, it transmitted vibrations through its shaft, down a pulley belt and out another shaft to the gears turning the bobbin. The solution was to reposition the sewing machine's motor closer to the bobbin so that its mass damped the vibration.

Lyon engineers still exorcise rattles and screeches, but now they also frequently work on sound quality. Too much noise remains an issue, but they also want to know if a product is making the right noise. As Richard Lyon puts it: "Noise is as much psychology as physics."

Car buyers, Lyon points out, are apt to spurn a car if its doors shut with a tinny clank. They will favor a model with doors that solidly thud. "Sound is information," he explains. Consider the clunking sound made by some clothes washers as they open and close valves to let water in or out. Those clunks can be annoying, and some manufacturers have, in fact, eliminated them. But it turns out that the clunks tell users when the machine is changing cycles. "My wife's new washing machine doesn't clunk, so they had to add a buzzer to tell you when the cycle changes," explains Lyon.

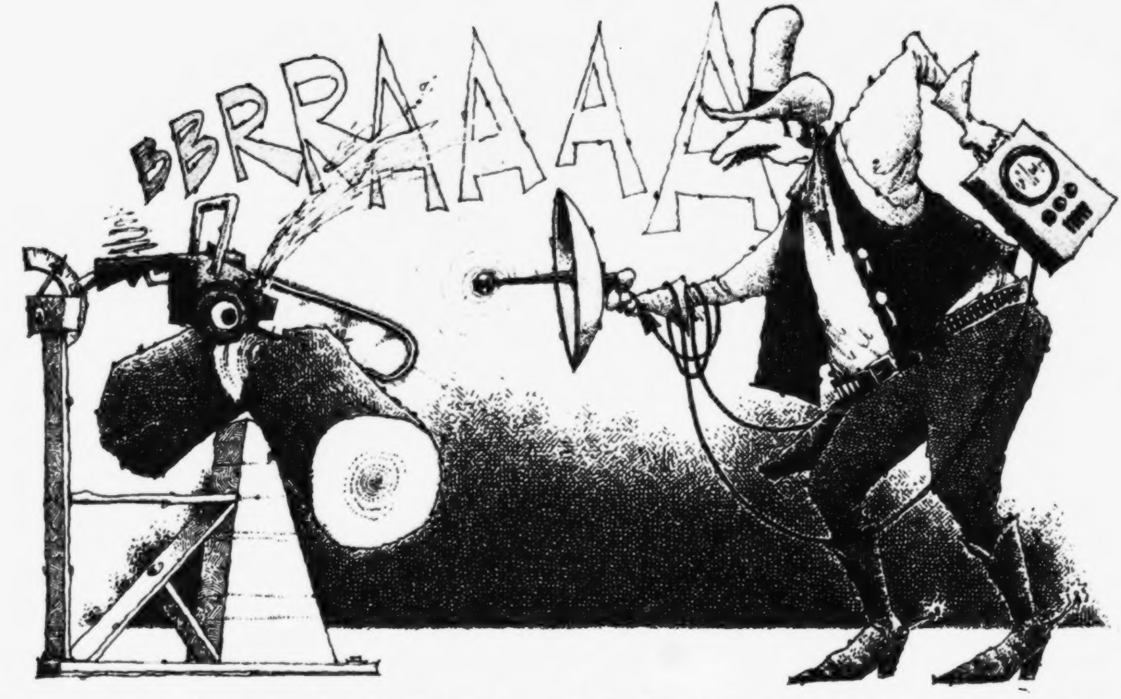
Thus, fiddling with product sounds inevitably leads engineers into "psychoacoustics," which is the interplay of sound and mind. "A lawn mower's racket is annoying, but a skinhead motorcyclist coming down my street, making exactly the same level of noise, is much more annoying," Lyon remarks. He cites a study of Los Angeles freeway noise: "As you got farther away from the freeway, annoyance went up!" That was because neighborhoods farther from the freeway were wealthier. "People living next to the freeway had the benefit of lower housing prices, and they had to cope with many troubles besides traffic noise," he notes. "Farther back, in the luxury neighborhoods, even though the noise was muted, it seemed much more intrusive and irritating."

Of course, sound is physical too. When something vibrates, like an elm branch a woodpecker is jackhammering, it sends matching vibrations rippling through the atmosphere, the air molecules alternately rarifying and bunching. And those physical pulses can have physical

Lyon researchers, analyzing each component ruthlessly, subject strident vacuum cleaner to zealous scrutiny.

Illustrations by Jeff Seaver

1604



Manufacturers will often deputize a hired gun, a.k.a. an acoustics expert, to target the source of a product's offending whine or whir. Ranking among the noisiest of appliance varmints are the chain saw and the blender.

consequences. The Lyon engineers once were called to an electric power plant where earsplitting vibrations from steam pipes heated to 900 degrees F were so intense that parts came flying off.

Sounds can deafen. OSHA, the Occupational Safety and Health Administration, has limited workers' exposures to no more than eight hours per day at sound levels of 90 decibels, four hours at 95 decibels and two hours at 100 decibels, with special limits for quick, sharp "impulsive" sounds, like explosions. Some RH Lyon noisebusting is pure decibel reduction to meet the safety standards. That can be difficult. But the company's new focus on tuning gadgets until they sound pleasing to consumers can be even tougher. For one thing, customers send out contradictory signals.

"People want quiet appliances, but at the same time they equate noise with power," says Lyon. "How do you make a quiet food processor that sounds powerful enough to handle the job?" And successfully quieting a noise, like a car's engine racket, can unmask a most unwelcome panoply of previously unheard noises, such as the heater-fan's incessant drone. "Recently I replaced my computer's hard drive after living for years with the tremendous racket it made, and now I've noticed that my wall clock has an exceedingly loud tick," comments RH Lyon engineer David Bowen, glumly. "I'm experimenting with rubber mounts and damping for the clock."

Lyon's first sound-quality customer, in the 1970s, was the Singer Company. Singer had lined up sewing machines, its own and competitors', so a sales vice president could listen to each in turn. "I want all our machines to sound like that one," he pronounced, pointing to one model.

"The result was total consternation," recalls Richard Lyon. "They didn't know what part of the sound he liked—so they put the magic machine in a closet." That machine became the standard for the ultimate in a sought-after sound. Every so often, engineers would have another try at fine-tuning their own sewing machines' sounds. "They would run the magic machine, but, of course, it became noisier with time because the oil had drained from the bearings," Lyon says.

One reason it is difficult to get sounds just right is that the overall sound may be a blend of sounds contributed by a machine's various parts. And even the sound of a single component may be a medley of sounds from its own subcomponents. Also, small transient frequencies at the initiation of a sound often provide its "personali-

Richard Wolkomir reports that, since he wrote this article, his refrigerator has developed an annoying growl and his computer's hum seems much louder.

ty." "Those initial transients are really the difference we hear between a piano and an oboe," explains Lyon. "Or make voiceprints of yourself saying 'bah' and 'dah' and you'll see almost no difference between the 'b' and the 'd' sound; the real difference is the position of your mouth in each case as you start the 'ah' sound."

In the early 1970s, the Environmental Protection Agency and OSHA campaigned to get the decibels down. Noise pollution was news. But enforcement-hampering budget cuts during the 1980s deep-sixed the issue. Today concern about noise is again ratcheting upward but not because of new regulations. One reason is that the "soundscape" seems noisier. Richard Lyon knows of no scientific study of noise-level changes, but he points out that, for one thing, there are more of us. And some of us do particularly noisy things, like amping up our car stereos so high that people a block away feel the rumble, or demufflering our Harleys. And we all have more motorized tools and appliances and toys to contribute to the general din.

For instance, suburbs nationwide now experience nearly continual lawn-mower snarl, backed by the buzz of weed whackers. Leaf-blower roar can be so unbearable that many towns have mounted ban-the-blower campaigns. Dirt bikes, snowmobiles, all-terrain vehicles and chain saws make the notion of a quiet day in the country as quaint as a Currier and Ives scene. America's lakes and rivers now throb with speedboat whine and the screech of water-scooters and other motorized craft. And while our automobiles are quieter inside, many are louder outside. One reason, offers Lyon, is the shift from eight- and six-cylinder engines to noisier four-cylinder ones. Also, today's radial tires have stiffer treads, which make them hum.

For the sound sensitive, there is a hopeful note: industry is increasingly concerned about noise. The reason is international competition. "Europeans and East Asians are much more sensitive to noise than Americans, and so their products tend to be quieter," Lyon observes. He cites the U.S. maker of a whirlpool pump that shipped its latest model to its British branch. The British office said it could never sell the pump in Europe because it was too noisy. Lyon then helped the manufacturer quiet the pump for the European market. Prodded by such overseas competition, many U.S. corporations are trying to tone down their products' annoying squeaks and pocketa-pocketa-pocketas.

"Who wants to be awakened by your bread maker starting at 3 in the morning, going *whir-whir* as it makes a turn, waits for the dough to settle back down on the hook, and then goes *whir-whir* again?" Lyon asks.

To cure such *whir-whir* problems, RH Lyon engineers usually start with a "sound audit." The aim is to determine what noises each component contributes to a product's overall sound. "We've taken away this vacuum cleaner's suction fan," says Peter Hammer, a biomedical engineer who works part-time here, interrogating appliances. Right now he is "questioning" an upright vacuum cleaner. Hammer explains that he separately records and analyzes the sounds produced by each of the machine's moving parts. He is about to listen to the motor. To do that, he disconnects other parts, such as the suction fan. But that creates complexities. "Without the suction fan attached, the motor would speed up and change its sound," he points out. To compensate, he has hooked the vacuum cleaner motor to another motor under the wooden podium upon which the vacuum stands. The second motor runs backward, pulling against the cleaner's motor. He can vary the pull to simulate the suction fan's drag, whether the vacuum is roaring over a carpet or running its furniture-cleaning attachment.

Hammer's workshop is filled with intriguing and arcane clutter. Cottony material lies heaped in a corner. Plywood panels lean against the walls, which are hung with mats. The aim is to randomly mix the sounds com-

Sound-sensitive consumers will find engineers waging war against whirs: some gadgets are indeed piping down.

ing from the vacuum cleaner, neutralizing echoes and reverberations to get a clear reading.

Hammer has attached a microphone to the top of a camera tripod and pointed it at the vacuum cleaner. "It's approximately where the ear of a person operating the vacuum cleaner would be," he says. He slowly turns up the juice. The vacuum whines like a Boeing 737 warming up (loud), taxiing (even louder) and taking off (you put your fingers in your ears). On a computer monitor, Hammer eyes a jagged graph line, a snapshot of the sounds emanating from the vacuum cleaner at any given moment. With the motor spinning 400 times per second, one peak stands at 80 decibels. "The next phase," Hammer notes, "will be to break down the overall sound produced by this vacuum cleaner's motor into its parts, like the sound contributed by its brushes or its cooling fans—even components have components."

Once the engineers have graphed the sounds produced by the vacuum cleaner at various operating speeds, and broken those sounds down into the contributions from each component, and broken those sounds down, in turn, into the contributions from each component's parts, they feed the data into a computer. Right now acoustic engineer David Bowen is summoning up on his office monitor the data accumulated thus far from the vacuum cleaner.

"This is the motor's sound," Bowen indicates, producing a graph on the screen. Simultaneously, the computer's speakers issue a hissing roar, the noise in question. Bowen fingers the keyboard, and the screen's graph shifts, showing the noise made by air flowing through the vacuum. The speakers emit waterfall noises. Again he changes the graph, and now the noise sounds almost exactly like foghorns. "That's the sound of the agitator on the carpet," he explains. Finally, the computer emits an eerie, high-pitched hum, the noise of the vacuum's main suction fan.

Like a pianist at a keyboard, Bowen can play with the sounds, electronically altering them to see what would happen if he changed a certain part on the vacuum cleaner in a certain way. RH Lyon may arrange for a palette of such sounds to be judged by a carefully selected "jury" of homeowners who use vacuum cleaners.

"The jury would hear the vacuum's baseline sound," says Bowen, resummoning the hissing roar. "Next, we might raise the airflow sound a couple of stages and raise the motor sound." He punches keys, and the noise from the speakers changes to a Bronx cheer. It shifts to a starship going into warp drive. The jury would evaluate the various sounds. "We're trying to get a combination of higher perceived power but also a more acceptable sound," adds Bowen. The vacuum cleaner's manufactur-

Scientists have developed sophisticated methods for assaying public perception of appliance noise levels: a panel of consumers listens to computer-simulated racket and rates the sound quotient of various models.

er will receive a report detailing suggested design changes, such as altered blades on the suction fan or a reconfiguration of a nozzle.

Sometimes, despite the engineers' little victories—a quieted juicer, a muted hedge trimmer—the war against noisiness seems to falter. Richard Lyon cites refrigerators. When he was a child in Evansville, Indiana, his father, a high school dropout, worked as a self-taught analytical chemist for the Servel Refrigerator company. Its gas-powered refrigerators had no moving parts. "You can't get any quieter than that," states Lyon. Such silent refrigerators now are rarities. Quietness has been sacrificed to a quest for more interior shelf space.

In a refrigerator, a liquid—usually Freon—is pumped through the appliance, where it evaporates into a gas as it absorbs heat from the refrigerator's insides. The gas is then compressed and forced through a big exterior coil, where it relinquishes its collected heat and becomes a liquid. As it reenters the refrigerator, it vaporizes again into a gas, beginning another heat-extracting run. In older models, the condensing coil is behind the refrigerator; in newer models, to make room for deeper shelves, the coils are underneath. But down there, insufficient air moves past the coil to cool it by convection. "So they added fans," says Lyon. As a result, refrigerators are noisier.

But refrigerators are about to get even louder, Lyon predicts. That is because Freon—today's standard refrigerant—is accused of harming the ozone layer and will be phased out. Whatever replaces Freon will probably need higher pressures for liquefaction. That extra effort will mean more decibels.

Lyon is a veteran of these "win some, lose some" racket wars. In 1946, when he was in high school, he took a Lee De Forest radio-repair course that hooked him on acoustics and ultimately led to a PhD in physics from MIT. He became vice president of a Massachusetts sound-and-vibration consulting firm, working on such projects as quieting nuclear submarines and hushing the Saturn V's rocket-shaking lift-off roar. In 1970 he returned to MIT as a professor of mechanical engineering. Physicists had by then ceded acoustics to engineers, believing all basic discoveries had been made. On the side, Lyon developed his small acoustics company. And in June 1995 he retired from MIT to devote his full attention to RH Lyon Corp and the war against electric-carving-knife buzz and can-opener whir. For appliance vivisectionists, these are busy times.

"This makes too much noise, unpleasant noise," announces one RH Lyon engineer, Richard Cann, in the inflections of his native London. He is holding up a weed whacker. From the same bench he picks up a partially dissected leaf blower. "This fellow is the most unpleasant. It's now banned in about 150 communities," he continues, contemplating the eviscerated blower as if it were a dead adder. "It has to be lightweight to ride on your back, which leaves little room for noise-control materials," says Cann, adding that the gasoline-powered tool—essentially a vacuum cleaner in reverse—blows out a 250-mile-an-hour gale. "You've got the wind whooshing through a nozzle, plus a noisy fan, and manufacturers worry their products will not be usable."

Once they've conducted their analysis, experts give manufacturers exact specifications for noise reduction.

Cann, a Cambridge University-educated engineer, has been a part-time RH Lyon noise detective since 1977. He has now turned his attention to a belt sander, which he has under sonic surveillance. The power tool hangs from strings, suspended just above the floor. "That's where you might hold it to give it a try at the store," he explains, adding that he also will probe the sander's sounds when it is actually sanding a board. "The manufacturer wants to know why it's so noisy, and what changes they should make on their new model." Inside the tool, Cann notes, a high-speed motor drives a belt, which turns a speed-reduction gear. The gear then turns

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the sanding belt. Because the motor generates heat, the sander's metal casing is slotted for ventilation. An internal fan draws in cooling air and blows it out, while a second fan blows sawdust through a channel inside the sander and out a slot at the back into an attached bag.

All three processes—belt driving, motor cooling, dust extraction—are driven by the same motor; all make noise. Cann must identify which processes are making which noises, pinpoint objectionable sounds and decide what to do about them. That means sleuthing.

"For instance, look at this belt that runs inside the sander," Cann suggests. The belt is ridged to engage cogs on the pulley that turns it. "Each time a ridge of the belt fits between cogs on the pulley, a little puff of air squishes out, creating a noise. The pulley has ten teeth, so the belt is making ten air puffs every time the motor turns, creating an amazing amount of noise." Meanwhile, the sander's fan blades produce whirs and buzzings. "You also get turbulence as the fans move the air—and with the grating of the sander against wood, altogether it sounds like a small jet taking off," says Cann.

One key question is how the sander radiates its sounds. Do all the sounds come from the vibrating of the sander's metal shell? Or do some noises emanate from inside, through the sander's ventilation slots? To find out, Cann has puttied up all the ventilation slots to see if that makes a difference. But, as usual, the test creates its own complexity. "We have to test the surface vibration before and after puttying up the vents to be sure that the putty itself is not changing how the shell of the sander vibrates," Cann points out. "Our other concern is that, with the vents puttied up, will it melt down? So we have to do our tests quickly."

That is what Cann now does, aiming a microphone at both unputtied and puttied sanders and letting them roar. The sounds turn up as frequency-graph squiggles on a nearby attached computer, with spikes indicating particularly loud noises. "That one's about 100 decibels for the user," says Cann, pointing. Because he knows the specifications of the sander's various moving parts, he

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1610

Singer engineers pay homage to one pleasantly whirring model: it set the standard for their sewing machines.

can mathematically deduce which parts are making which spikes. By comparing the puttied and unputtied sanders, he can determine which sounds waft from the ventilation slots. And by puttying only some slots, he can begin to pinpoint which parts make which noises. "Look at the graphs," he says. "The air holes are a major part of the sander's problem, and you can't fix it without dealing with that—you can see that with the puttied sander we've reduced the noise by 10 decibels."

It is painstaking work. But backers of an experimental new technology called active noise control (ANC) promise to make silence easy. The idea is to wipe out a noise by generating a diametrically opposed sound: where the unwanted sound's time graph has a peak, the anti-sound has a valley, and vice versa. When the opposed sound waves intersect, they cancel each other out and all is silence. At least, it is in theory. In practice, ANC would require equipping an offending machine—let's say a noisy air conditioner—with microphones to pick up the unwanted noise, a computer chip to analyze it and design the anti-noise, and speakers to send out the anti-noise on its silencing mission.

"It's extremely oversold," states Richard Lyon. Most noise, he points out, is not a single sound but a multi-source cacophony. He doubts it will ever be practical to analyze changing sounds from several sources and, in a twinkling, to generate canceling counternoises. He says ANC works best where noise funnels through a defined point. He cites protective earphones for factory workers. Also, he mentions that some companies are working on ANC car mufflers. But a stumbling block has been getting the ANC equipment to survive more than a few months in a car's harsh underworld.

RH Lyon engineers deal with car noise the old-fashioned way. One company, for instance, asked Lyon to determine how much noise was emanating from beneath an American luxury car's chassis. Certain European luxury cars had underbody shields—did that make them quieter? The Lyon engineers fabricated an underbody shield to test the theory. They filled the car with instruments and an "acoustic head," which is a dummy head with microphones where a human's ears would be, so that it "hears" what a person in the same location would hear. Then they repeatedly drove the car up a New Hampshire mountainside, turned off the engine and coasted back down at 70 mph, with the electronic ears pricked up. "Did you ever try to drive a big luxury auto with the power steering turned off?" asks Richard Cann, remembering the project's rigors. It did lead to a conclusive finding: no noise came from below. No shield was in fact necessary.

Sometimes, instead of trying to eliminate noise, the acoustic engineers exploit it. For General Electric, for example, RH Lyon developed a diagnostic system that senses surface vibrations on a diesel locomotive's engine block. The data—properly processed—reveal combustion pressures inside each of the diesel's 16 cylinders. It is somewhat like a physician checking a patient's health with a stethoscope. Occasionally, the engineers actually become noisemakers. For RCA, they developed a new home theater system in which the speaker sitting atop the video screen acts as a ventriloquist. Sounds emanating from the speaker are manipulated so that they seem to come from the mouths of the actors on the screen below.

Usually, however, the engineers' goal is silence. There was the Malaysian surgical glove factory, for instance. To make the gloves, workers repeatedly dipped porcelain models of a human hand into liquid latex, which then dried into gloves. Air jets then blew the new gloves off the porcelain hands. But that meant 250 gloves blown off 250 porcelain hands every 30 seconds. The sound was literally deafening—125 decibels. RH Lyon engineers used a specialized camera to study the problem: they photographed shock waves moving through the air as the air jets blew the gloves off. They discovered that altering the air jets' nozzles would reduce the noise by 20 decibels, enough to allow those workers equipped with ear protectors to safely stand nearby.

RH Lyon's case list sounds Sherlockian. What mysteriously vibrated the Japanese luxury car? And why did that new windshield-wiper motor hum? There was the clunking elevator in the millionaires' condominium building. The Smithsonian Astrophysical Observatory x-ray telescope that shivered. The portable generators for pleasure boats that whined in the night. "There was a noisy computer hard disk, too—the solution turned out to be drilling holes in the right places," remembers Richard Cann.

Such work can lead to sensitive ears. Cann has discovered that by repositioning a newspaper that he is holding up, he can make his wristwatch seem to tick louder or softer. And not long ago, at lunch in a noisy Cambridge café, David Bowen suddenly looked distracted. A new roar, muted by distance, had added its note to the din. Abruptly Bowen brightened: "Dishwasher!" he announced triumphantly.

Richard Lyon, like most people, dislikes screeching dental drills. Old-fashioned dental drills, he notes, were driven by a cable at low speed. Modern drills are air-powered, and they produce an unnerving high-pitched whir. "Everybody assumes it's from the air, but that's producing sounds above the range of human hearing," explains Lyon. "What you actually hear is the vibration—I figured out how to fix it, but it turned out there already was a Japanese patent."

After all these years as an acoustic sleuth, Lyon has pretty much heard it all—the clunks, wheezes, screeches, buzzes, bangs, roars, shrieks and pocketa-pocketas. A man gets jaded.

Lyon shrugs, almost apologetically. "I'm probably more tolerant of noise than most people," he says.

Orchestrating appliance sound profiles of the future, researchers predict they will vanquish even our most recalcitrant everyday appliances, reducing whines, rasps and clangs to tolerable levels of background noise.

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By Richard Conniff

When it comes to moths, nature pulls out all the stops

Cross-dressing, sucking blood, spitting poison: moths do such crazy things, it's no wonder researchers stay up all night studying them

Once, not so long ago, people believed that moths were the souls of the dead flinging themselves against the windows of the living. "'Twas Annie's soul that beat outside and 'Open! open! open!' cried," a sentimental poet wrote of a moth. Lonely travelers out on the moors, encountering moths of a European species fluttering together at dusk, named the creatures "ghost moths." The scientific name for the genus is *Hepialus*, which means "shivering nightmare."

So the story of an English clergyman who reared moths for a hobby fits the tradition. He wasn't a superstitious man. The crypt of the cathedral where he was canon was simply a good place to keep moth larvae over the winter; the oak coffin of a local duke, merely a convenient shelf. But one spring day the canon arrived late to retrieve his cage of larvae, and under it he found a series of neat holes drilled in the lid of the duke's coffin. Then he heard a rustling sound from within the coffin, followed by something rap-rap-rapping. What the canon did next may seem odd. He unscrewed the lid of the coffin.

It had dawned on him that the caterpillar of the carpenter moth, the species he was raising, can bore holes even into an oak coffin, and naturally he didn't want to lose his specimens. Opening the coffin, he plucked the moths from the duke's skull. It was a little macabre, but a true moth enthusiast must be prepared for the unusual because the private lives of the moths are nothing if not strange.

One researcher who knows just how eccentric moths can be is David Wagner, a lepidopterist at the University of Connecticut. At the moment, he is racing across the wooded Connecticut hills in his station wagon. There's a sickle moon over Bear Mountain to the west, and the night sky is hazy and crystalline, like sugared water. The soft *pppt-pppt* is the sound of bugs meeting windshield. "Lots of insects in the headlights, that's a good sign," Wagner remarks, pushing the accelerator a little harder.

It's a perfect night for mothing, and Wagner already has his generators and black lights humming at strategic locations among the local lakes and fens. He is a zealous moth-man. The Gary Larson *Far Side* cartoon on the door of his office depicts an "entomological rodeo," and you can just imagine Wagner launching himself out of the chute, hell-bent on moths.

At the first stop, he squats down in the pale violet gloaming of the black light, a standard device for attracting insects. He sweeps the beam of his flashlight across the white sheet he has hung up as a backdrop,

Moths large and small (left) congregate on illuminated collecting sheet set up in Costa Rica. Silk moth from India (opposite, enlarged nine times) rests on a log.

Hawkmoth extends its long proboscis to drink nectar from a flower. Species is known for its streamlined shape.

which is seething with long-horned caddis flies, stag beetles, giant water bugs and 200 or so species of moths. Wagner picks out a rosy maple moth the colors of a peach melba, and a striking green-and-black-mottled leuconycta. He points at a chrome-plated creature smaller than the crescent on his fingernail. "You realize how many of these tiny things are moths?" he asks. "It's alarming, for me. I have to collect 'em."

He directs a helper to collect a reddish moth with gold markings. "The pitcher plant moth. Book 'em, Danno," he says. Then he spots a moth perched on this reporter's knee, wings folded, with a profile like a steam locomotive. "*Autographa ampla!*" he says, and scoops it into the killing jar, which has a cyanide-laced tissue at the bottom. The specimen will go into the university collection, as part of the supporting evidence for this inventory of local moths.

After a while, Wagner steps back to survey his winged riches, which seem actually to have increased in number, thickened in density, with the waxing of the summer night. Someone points out a *Polia* moth. "Where's the *Polia*?" he asks impatiently, pushing the Boston Red Sox cap back off his high forehead. "It must be getting toward midnight. I'm not getting enough done. Oh man, I'm going to have to select 60 species out of all these moths that I want to collect." The moths are now flying down our shirts, foundering in our scalps, flapping blearily across our mouths and otherwise threatening to overwhelm us.

"Look at that abdomen," Wagner comments, picking a specimen off the sheet. "Purple, orange . . . ooh, he's oozing poison on me! He's bleeding right out the thorax, on purpose. Anybody want to taste it? All I can tell you is that it's bitter." But by now everybody seems to have eaten their fill of moths accidentally.

According to a familiar biological saying, a close study of nature suggests that God suffers from an inordinate fondness for beetles. But clearly God likes moths, too. There are more species of moths in the world than all the species of mammals, birds, fish and reptiles put together—12,000 in North America alone.

You surely would not guess this from the popular literature. Butterflies, those flashy arrivistes, get all the publicity, though they constitute less than 7 percent of the lepidoptera. They get their picture on postage stamps. They get mawkish song lyrics ("Butterflies are free to fly, fly away . . ."). They get butterfly zoos and gardens (SMITHSONIAN, August 1995).

Moths, meanwhile, get a bad rap. The hugely popular novel *The Silence of the Lambs*, for example, features a psychopath who breeds death's-head moths, murders women gruesomely and plants a pupa in the throat of each of his victims. Moth-wise, the book has at least one redeeming feature: the FBI agent heroine ultimately finds love with a normal sort of moth-man, an entomologist at the Smithsonian. But while the first moth-man made it into the hit movie version of *Silence*, the second didn't, and this is how it goes with moths. The last time they got good media buzz was when Mothra wrapped Godzilla in silk.

Moths are known for being drab and boring. Also, bad: some of our most notorious field and garden pests are leaf-ravaging caterpillars, such as corn earworms and tobacco budworms, which grow up to be moths.

But moths are important pollinators, too, and some plants might eventually go extinct without them. As caterpillars, they are the primary food of songbirds. (In fact, moths get eaten by everything from shrews to the grizzly bears at Yellowstone National Park, which gorge themselves on army cutworm moths to fatten up for hibernation.) They are also the source of the 5,000-year-old silk trade. Moth silkworms were once so highly esteemed that, in one of the earliest recorded acts of industrial espionage, priests hid them in the hollows of their canes and smuggled them out of China.

"I started out collecting butterflies. Then I grew up and switched to moths," one of Wagner's helpers, a collector named Ben Williams, told me. "People think they're all ugly miller moth kinds of things, and for that reason they became more fascinating to me—for the variety of size and shape and color and life history. The biggest lepidopteran is a moth [a Southeast Asian spe-

Last year the many-sided Mr. Conniff, a frequent contributor, wrote about fleas and profiled Frederick Douglass, the abolitionist. He lives in Connecticut.

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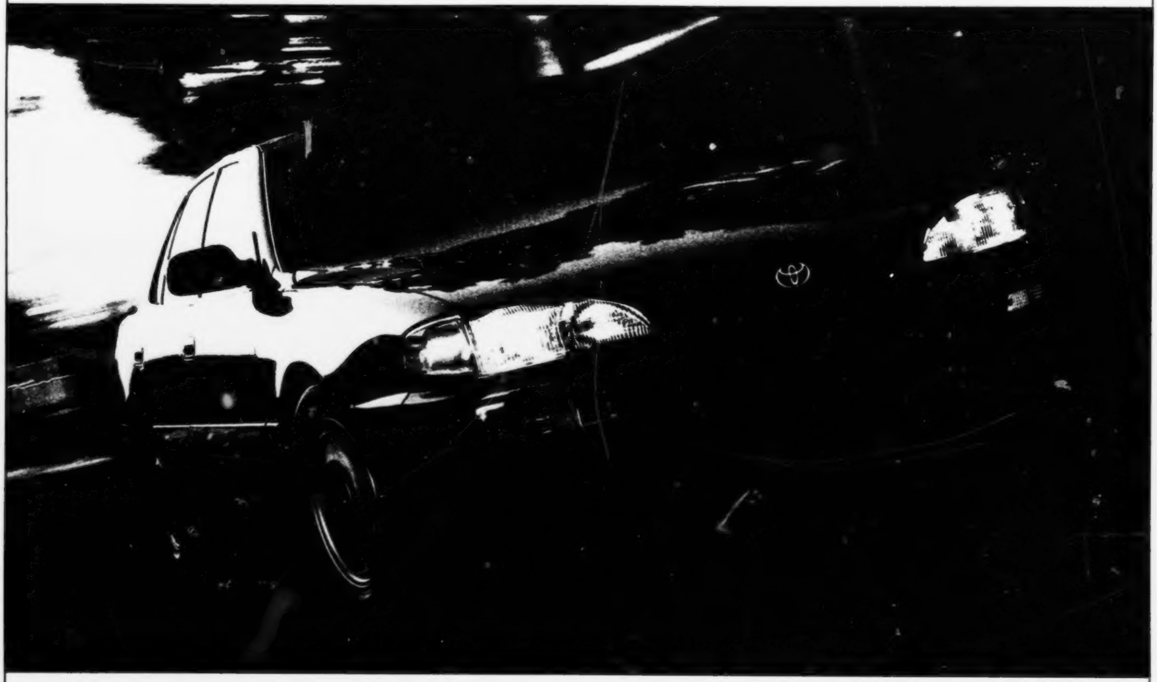

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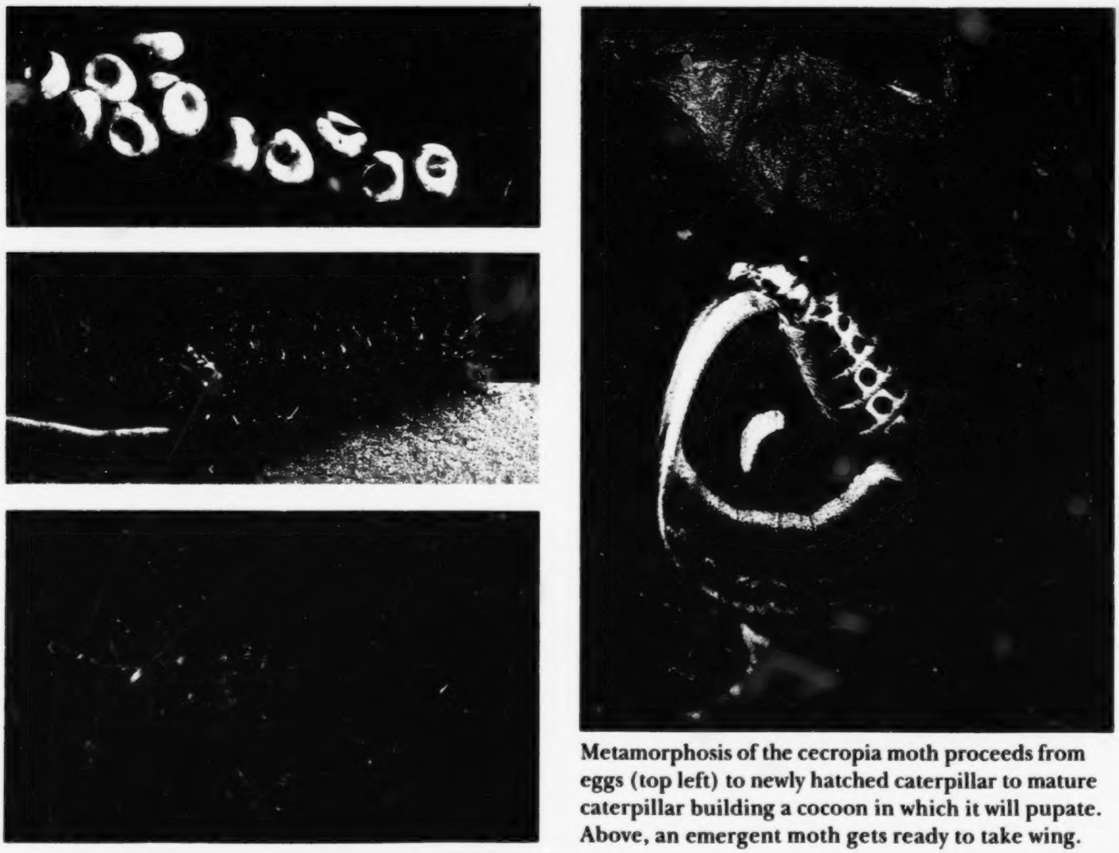
cies with a 10-to-12-inch wingspan]. The smallest lepidoptera are moths. The ugliest lepidoptera are moths."

Williams, a retired prep school headmaster, was once a Marine captain protecting the Presidential retreat at Camp David, where some of his men noticed that he took an inordinate interest in life around the mercury vapor searchlights. "They'd say, 'Sir, I have a moth you might be interested in.' They always squashed it with the butt of their M1s and they'd pull this mashed beast out of a cartridge belt." Williams doesn't even bother to mention that the most beautiful lepidoptera are also moths, but at home he keeps drawer after drawer of showy specimens, each meticulously preserved: bat-size cecropias and sherbet-colored saturniids, moths with tiger stripes and leopard spots, hawkmoths that rival hummingbirds in size, shape and color. "I'm a sucker for a pretty face," Williams confessed, the day he showed me his collection.

Moth behavior, too, is much more interesting than people generally believe. Some moths, for example, practice virgin birth. In other species, the females are sexually promiscuous and seek out toxic males as a way to improve the health of their offspring. (More about that later.) One moth caterpillar eats only horns, another moth pierces grapes for their juice. Yet another survives on a diet of tears, fanning out below a cow's eye like facial armor. One moth species, in Southeast Asia, can pierce skin and suck blood. One spits cyanide.

Even among species that confine themselves to the more familiar business of sipping nectar from flowers, it often seems that there is no ecological niche too obscure to exploit. In one famous example, Charles Darwin examined an orchid from Madagascar with a foot-long nectary tube and postulated that there had to be a hawkmoth with a tongue almost that long to pollinate it. The moth eventually turned up, 40 years later. Like other hawkmoths, it uses blood pressure to uncoil its huge proboscis as it hovers in front of the flower. Then it inserts the tip of the proboscis into the nectary opening as if threading a needle. There are advantages for both flower and moth in evolving toward greater length. So researchers, having discovered an even larg-



Metamorphosis of the cecropia moth proceeds from eggs (top left) to newly hatched caterpillar to mature caterpillar building a cocoon in which it will pupate. Above, an emergent moth gets ready to take wing.

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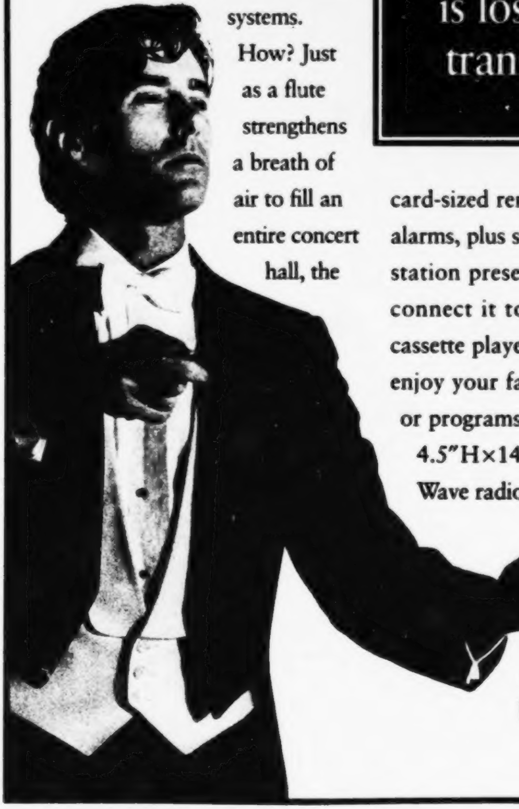

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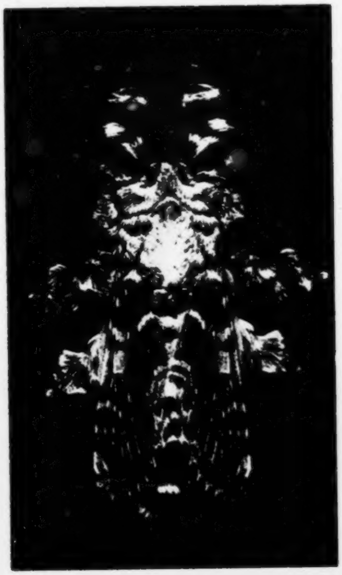
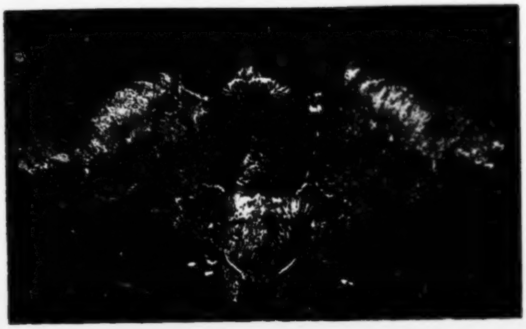
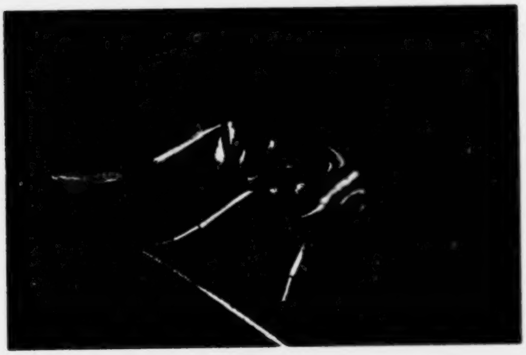


A bizarre species of flannel moth resembles an Amazonas spider.



Apatelodid moth, with its head down, looks like a chewed leaf.

Tiger moth of Venezuela masquerades as a cockroach.



A dead ringer for a wasp, the sesiid moth is found in Jamaica.

er orchid species, are now seeking a hawkmoth with a 15-inch tongue.

If you are getting the idea that nature does not know where to stop with moths, you are correct. It is not content, for example, merely to give us the quintessentially indolent sloth, hanging plantlike in the rain-forest treetops. It must also give us the even idler sloth moth, which breaks off its wings and lazes its life away in the sloth's fur. When the sloth clambers down a tree trunk for its weekly defecation, the female moth drops off to lay her eggs in the fresh dung, on which her offspring will wallow their way toward adulthood.

The peculiarities of moth behavior make butterflies, for all their flash, look just a tad shallow. There is a moth for every season, and the tantalizing thing is that these insects exhibit their startling variety not just in some South American cloud forest but in the average suburban backyard, as we sleep. Wagner has identified more than 1,200 different moth species on his Connecticut property. He specializes in microlepidoptera, or what Williams refers to as "itty-bitty little schnitzers." During the busy season, from April to October, Wagner turns up a new one unknown to him every week or so. To a newcomer like me, even the commonplace moths can seem positively bizarre.

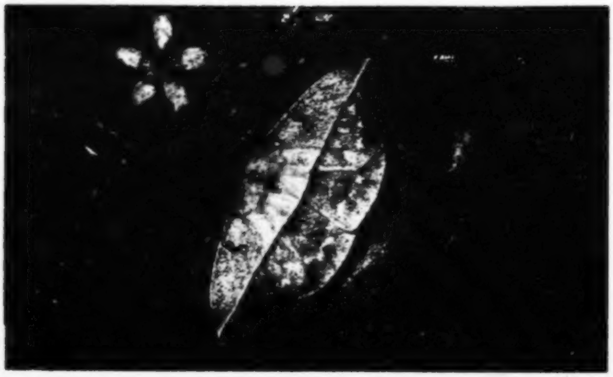
"Here's a really pretty bird-poop mimic," Wagner remarks, and there beneath the light perches a black-and-white splotch of a moth, cylindrical and with a moist-looking sheen. "They rest on leaves by day," he explains, "so it's a good thing to look like bird poop." So good, in fact, that perhaps a hundred different moth species in the Northeast alone have evolved this disguise as a clever way to make hungry birds look elsewhere.

A moth fossil survives from the Jurassic period. But moth species really began to proliferate, together with the flowering plants, in a great evolutionary outpouring about 100 million years ago. The butterflies probably evolved, much later, from the moths. Aside from the appalling difference in public relations, it isn't always easy to tell moths and butterflies apart.

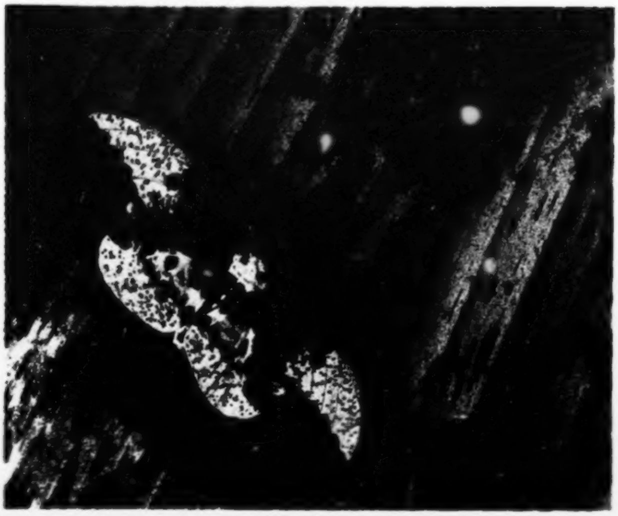
As a rule, butterflies fly by day, depending on bright colors to tell their archenemies, the birds, that they eat plant toxins and taste bad. They perch with their wings primly held up, tips together. Their antennae tend to have clublike knobs at the tips.

Some male moth antennae look more like feathers, and moths generally hold their wings out or fold them down over the abdomen, like an old cloth coat, the better to vanish furtively into their surroundings. By day the moths lie low, disguised as dead leaves, lichen, peeling bits of bark or almost anything else that a hungry bird might overlook. They generally fly at night, thereby avoiding birds.

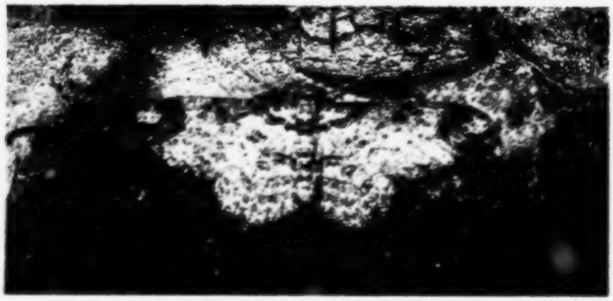
But it is unwise to be too confident about any of this.



Female lonomia moth camouflages herself as a fallen leaf in a Costa Rican forest.



A member of the Eupterotidae family, kin to the emperor moth, blends into colors of tree bark.



Mottled wings and muted colors make an inchworm moth hard to see on the jungle floor.

Many moths fly by day. One hawkmoth goes through the usual stages of lepidoptera development—egg, caterpillar and pupa—and then, on emergence, experiences a sort of secondary metamorphosis: it sheds the scales from its wings in a black puff and buzzes off on transparent wings, looking very much like a bumblebee. Not only is the coloration of the abdomen perfect, but this particular moth will tuck its tail under as if it were preparing to sting, startling any would-be predator just enough to make its escape.

Cross-dressing occurs even in caterpillars. Wagner turned up one, in his backyard, that starts out disguised as a bird dropping. Then it gets too big for the part and, with the help of huge eyespots on its back, pretends to be a snake. If this doesn't startle any bird that may peer into the caterpillar's daybed, Wagner tells me, "it has a backup—an extrusible structure loaded with noxious compounds that it wipes all over its adversary. One of the substances is butyric acid, which is the sickly sweet smell in vomit."

Sooner or later the moth enthusiasts I know all mention Noel McFarland, who is the unequaled student of his own backyard. McFarland seldom leaves his five-acre Ash Canyon property in the Huachuca Mountains of Arizona. His wife and daughter share the traditional Western fondness for what he calls "big habitat-destroying mammals," meaning horses, but he prefers moths, and there are plenty of them inside his fence line. He's collected about a thousand species so far, "counting only macros. If you added micros you could easily double or triple that."

McFarland started black-lighting as a boy at his family's house in Beverly Hills, where he collected almost 400 moth species on the back porch. After graduate school, he moved to Australia and became so obsessed with the local moths that, for six years, he covered a tolerant landlady's dining-room table with rearing cages and cluttered her kitchen with pupa pots. The result of that research was a weighty book: *Portraits of South Australian Geometrid Moths.*

He's been in Ash Canyon since 1979. The night I visited he took me on a tour of the six black lights he operates on the property. At 58, McFarland is a slightly built man with weathered skin, a close-cut beard and a few short ringlets of gray hair down over his brow. As he stands at the black light, he projects the contented air of a man utterly in his element, bathed in purple light and with moths clinging to the insides of his eyeglass lenses. "Those butterfly idiots are beating their brains out, running around in the sun. They have to carry their equipment with them," he said. "Meanwhile, we stay home, turn on the lights and the moths come to us."

By the back porch an evening primrose, the food of a certain sphinx moth, was flowering in the moonlight.

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The world of the lepidopterist, McFarland was saying, has its own social structure: society looks down on "eccentric" butterfly enthusiasts, who look down in turn on moth lovers. The micro-moth people worry that the macro types have a trophy mentality; the macro people mutter back that the micro types are pig-hunters. McFarland knew a lepidopterist in Australia who was so skittish about letting colleagues find out where he'd gotten his specimens that he used a mirror to print his locality labels backward. In a moment of indiscretion another moth-man once confided in McFarland, "You know, Noel, the very best collecting is in other people's collections."

Just then a big reddish moth came crashing in. "Oh, here's one of the wallbangers," McFarland said. "All saturniids live on stored fat. They have vestigial mouthparts. These guys all have real short tickets. They fly like crazy. They crash into branches. They don't see very well, and so in no time they're in tatters." Then a geometrid moth he'd never seen before also turned up. "You've got to be in a place for years and years to know what's there," he said. He quoted Henry David Thoreau: "It takes a man of genius to travel in his own country, in his native village, to make any progress between his door and his gate." But it isn't genius, he added. "It's staying home and doing lots and lots of observing, washing jars and changing caterpillar diapers."

McFarland's specialty is rearing moths from eggs, which means figuring out what the caterpillars eat. "I give them a salad of what's in leaf at the time they're hatching," he said. He arranges his offerings, with tissue underneath, inside a plastic box, hoping that he'll be able to find frass under one pile of the leaves—meaning that the caterpillars have found and eaten their natural food plant. But it's rarely that simple. The caterpillars have often evolved together with "some difficult, obscure little plant that's out there, and if you keep trying you may find it." He once spent four years desperately offering dozens of samples before he discovered the food plant for one species. Even then, the caterpillars often require constant nursing. McFarland has spent much of his life fretting about whether the cage temperature is too high or too low, and wondering if he should mist the caterpillars to keep them from drying out, or if one more squirt will turn everything to mush. "I just like finding things out," he said. "I don't give a

Gypsy-moth caterpillar displays chewing apparatus that makes it the scourge of evergreen and deciduous trees. Escape of the imported insect in 1869 resulted in infestations that still rage out of control today.

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1624

It is lovely to look at, but the rosy maple moth has an ugly reputation as a pest on oak and maple trees.

damn whether it has any application or not. I just like to solve the puzzle and then move on."

The puzzle often turns on the extraordinary ways one of those obscure little plants affects the moth's physical appearance and biochemistry. McFarland's book is full of photographs suitable for a child's game: What's wrong with this picture? Is that a casuarina twig? Or is it actually a caterpillar, perfectly colored and striped, holding itself immobile all day long with precisely the curve of a casuarina twig?

Among his backyard beasts in Arizona, McFarland in 1982 noticed one moth species so completely adapted to the local oaks that its spring-brood caterpillars are yellow-green and grow false pollen sacs, mimicking the tiny flowerlike catkins on the trees. But after the catkins fade, the very next generation of caterpillars grows up bumpy and gray, and these caterpillars spend their days studiously posing as oak twigs. The difference isn't merely skin deep: the flower-mimic caterpillars have small mouths and weaker musculature, for munching down the flower's soft catkins. The twig caterpillars have big, crusher jaws for eating leathery oak leaves. Before McFarland's discovery, scientists were of the opinion that these caterpillars belonged to two different species. But both of them grow up to be the same emerald green looper moth.

These kinds of adaptations to a single plant are one reason any humble backyard can support such a menagerie of moths. The moths conquer by dividing and subdividing their habitat. For instance, many moths appear on the wing only during the brief period when their food plant is in new leaf or flower. Even when they appear on the same night, different moth species often send out their mating calls at different set times.

"The night looks uniform to us, but there are often windows of activity for different species," Dave Wagner says, adding that a good lepidopterist may be able to tell the date within two weeks and the time within an hour or two by which species are flying. The moths have at least one additional advantage for avoiding confusion: they are acutely sensitive to the silent love songs sent out by members of their own species, usually composed of chemicals derived from the host plant.

What's that perfume you're wearing?

Enthusiasts have known for centuries that moths can attract a mate over long distances; one venerable collecting technique was to tie a female moth to a tree and wait for the males to swoop in and court her. Scientists working with silk moths at the Max Planck Institute in Munich began to explain this phenomenon in 1959, when they discovered, for the very first time in any animal, one of the chemical signals that are now commonly known as pheromones.

A female silk moth disperses just a billionth of a gram of her pheromone per hour and yet draws males from up to 120 meters away. The male's elaborate, comblike antennae are highly sophisticated olfactory sensors, sifting the air for minute traces of the pheromone. Each antenna has 1,700 hairs, and each hair has 2,600 olfactory pores, all attuned to that one aphrodisiacal scent. The hairs concentrate the pheromone at a million times the level in the air itself, and the lovesick male comes winging in. (Listen! You can almost hear in the background the throbbing violins from the sound track of some 1950s Hollywood love story.) It makes a bloodhound snuffling up a hot scent trail look nose-dead. The scent is so potent that some unscrupulous spiders have learned to mimic moth pheromones as a way of luring males to their deaths.

Male moths also produce a scent. When the male gets close enough to the female, his body sprouts an array of feather dusters and ticklers, loaded in some backyard species with the aroma of jasmine or cinnamon. These pheromones enable the female to determine if he is a suitable mate.

It's the "no cologne, no date" theory of moth mating, and biologist Thomas Eisner at Cornell University has described one of the most intriguing examples in Florida's ornate moth. This is the promiscuous female-toxic-male relationship mentioned earlier. The caterpillars of this moth feed on a type of pea plant rich in an alkaloid toxin. This toxin, though powerful enough to kill a cow, is harmless to moths. They use it as a deterrent to birds and other predators.

But the really intriguing thing discovered by Eisner and his coworkers is that, when it comes time to mate, the female judges the male's desirability by how much of this poison he's accumulated. And the way that she tells is from his cologne. The nastier he smells, it seems, the more she likes him.

But it gets even better: she'll mate with a half-dozen or so suitably toxic males. Each of these lucky guys puts about 11 percent of his body mass into the sperm package. Eisner and his associate Craig LaMunyon discovered, however, that only one of the males actually gets to fertilize the eggs. After copulation, the female determines which one, usually by selecting the largest sperm package. The other males get cuckolded. She uses the toxins they've given to her as nuptial gifts to anoint her eggs against predators.

It may be some consolation, if only to this writer, to know that male moths actually derive some benefit from carrying around all those toxins. It's not just energy spent in the cause of unrequited love. The plant poisons also protect the moths themselves: the scent of these moths is so distasteful that spiders actually cut the moths out of their webs and set them free. Plant toxins have the added effect of discouraging bats, the one significant hazard to night-flying moths.

Wagner, McFarland and any other moth lover will sooner or later mutter dark and politically incorrect sentiments about bats, which linger around their black lights picking off moths. P.B.M. Allen, a British naturalist who wrote on the sybaritic joys of mothing, once confessed to being so maddened by the sight of a pipistrelle seizing a prize moth that he got out his shotgun and blasted the bat into eternity. (Afterward, in a moment of horrified remorse, it occurred to him how threadbare the countryside would be if the birds, bats and other predators weren't out there busily keeping the moths and their caterpillars in check.)

But the moths are far from being defenseless against bats. They have evolved ears, enabling a moth to hear the bat's radar signals from 100 feet off—as much as ten seconds before the bat even knows the moth is there. With visions of gaping mouths and needle-teeth dancing in its head, the moth flies away. If a bat gets close enough to race in for the kill, the moth can also hear the crescendo of ultrasonic shrieking. It may still save itself by folding its wings and making a last-ditch plunge.

It is a dogfight out there in the evening sky. Some moths even send out ultrasonic signals of their own, and

Luna moth drapes its four-inch wingspread across a bed of phlox. It's believed the mock eyes deter predators.

researchers used to think the moths were jamming the bat's radar. But most now believe these moths are simply advertising the poisons they have picked up from their host plants. The bat gets the message, which roughly translated is: "I taste rotten."

By the time I got back to my own yard in Connecticut, after visiting with Wagner and McFarland, it no longer seemed like the same place. I went to bed feeling like a boy who knows that his toy soldiers will begin to march the moment he closes his eyes for the night. Outside my window, the slender twigs on the ash tree would suddenly come to life and walk off on caterpillar legs. Strange poisons would ride the air in the causes of love and self-defense. Fragments of bark would take wing. Fallen leaves would rise back up to the treetops, and a million bird droppings would be reincarnated as lepidoptera. By night, my yard now belonged, as it always has and probably always will, to the moths.

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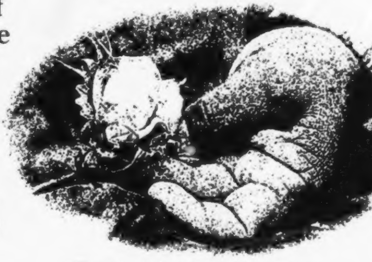

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Rediscovering an Idaho photographer

From 1895 to 1912 in her Pocatello studio, Benedicte Wrensted produced telling portraits of Northern Shoshone and Bannock Indians

In the fall of 1984, Smithsonian anthropologist Joanna Cohan Scherer made a startling discovery. In search of photographs for the Institution's *Handbook of North American Indians*, she had ventured into the cluttered confines of the Bannock County Historical Society in Pocatello, Idaho. Straining to view an array of vintage portraits of Northern Shoshone and Bannock (Sho-Ban) Indians, she was amazed to find two familiar images. They were, in fact, identical to two portraits she had found earlier that year in a collection of 148 unidentified glass negatives at the National Archives. The Bannock County images bore the imprint "B. Wrensted, Pocatello." And who was B. Wrensted? Scherer was determined to find out. So began ten years of painstaking detective work. Scherer consulted tribal elders from the nearby Fort Hall Indian Reservation, wrote countless letters and scoured libraries, museums and private collections. She checked business directories and census records from the turn of the century, devoured issues of the *Pocatello Tribune* spanning 20 years, conducted interviews and journeyed to Denmark, Wrensted's birthplace. As a result, a little-known woman photographer named Benedicte Wrensted has emerged from obscurity—bringing to light a priceless visual legacy. An exhibit of Wrensted's work is now touring the country and will be at the Jefferson National Expansion Memorial in St. Louis, Missouri, from February 3 to April 30.

Noted for her evocative handling of natural light and the painterly quality of her images—such as the 1897 portrait of two unidentified Sho-Ban dancers (left)—Wrensted was cited in 1901 as an "artist of talent and attainment." But wider acclaim eluded her, and her photographs were rarely published. Most were taken home by her customers—cowboys, school groups, and families and individuals from Pocatello and Fort Hall. "What sets Wrensted's work apart," says Scherer, "is her skill in portraying the humanity—the individuality—of the people who posed for her. She captured their presence with a dignity and beauty that transcend time and place."

Diane M. Bolz

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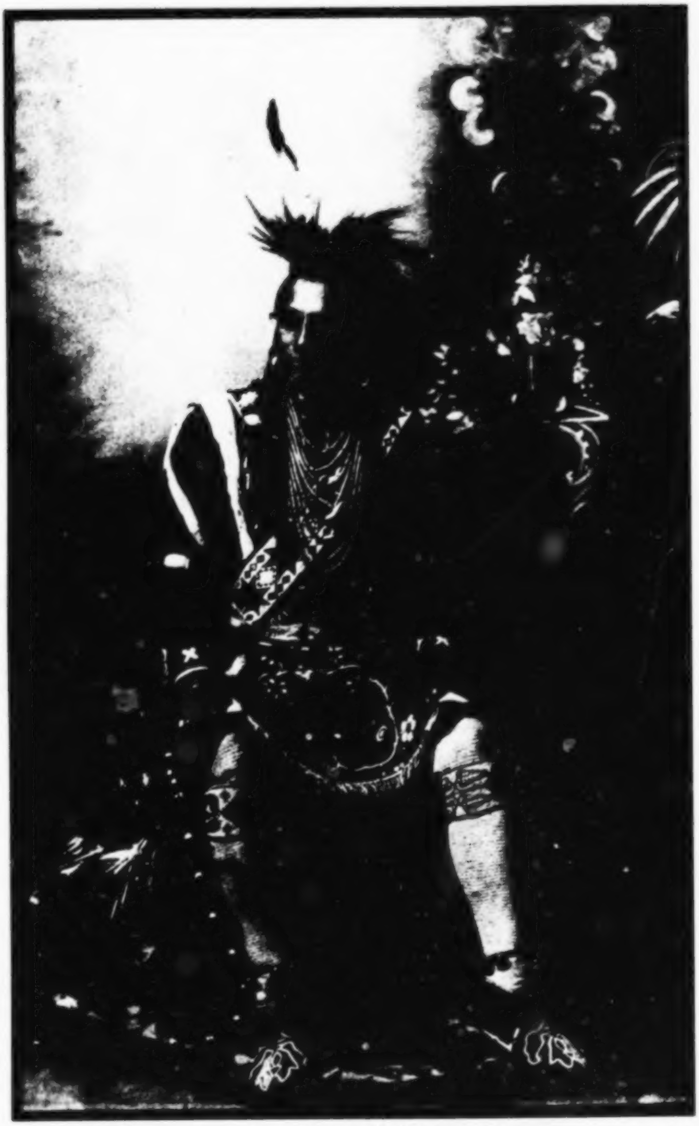
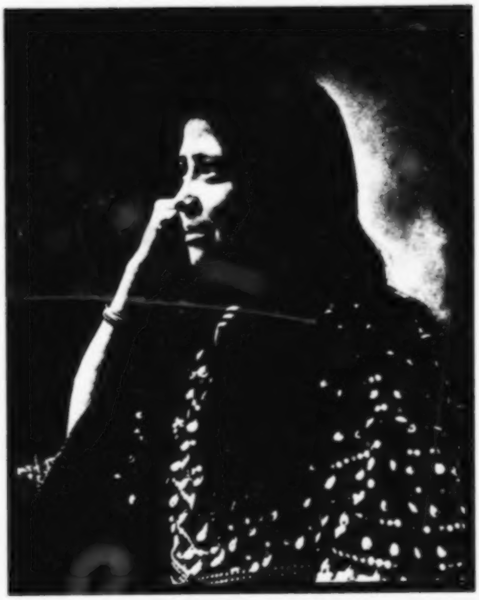
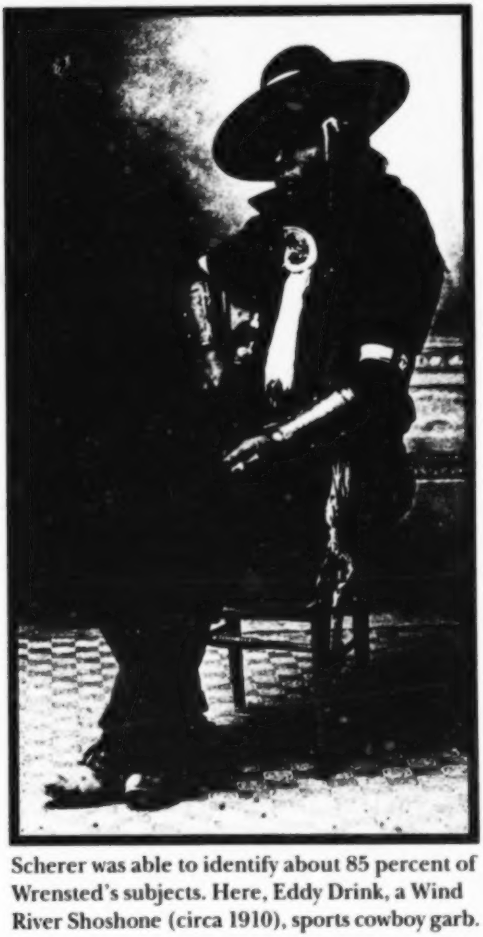


Portrait of Logan Appenay, a Bannock, in Grass Dance regalia exemplifies the evocative imagery that was often misused to reinforce the Noble Savage stereotype.



Sho-Ban girl, a member of the Soyouma family, wears transitional type of attire: cloth with cowrie shells, metal sequins, square-cut sleeves.

Photograph of Jack Edmo (standing, left), Joe Warren (far right) and two unidentified Bannock men illustrates range of Indian apparel—from chaps to breechcloths.



Scherer was able to identify about 85 percent of Wrensted's subjects. Here, Eddy Drink, a Wind River Shoshone (circa 1910), sports cowboy garb.

1626

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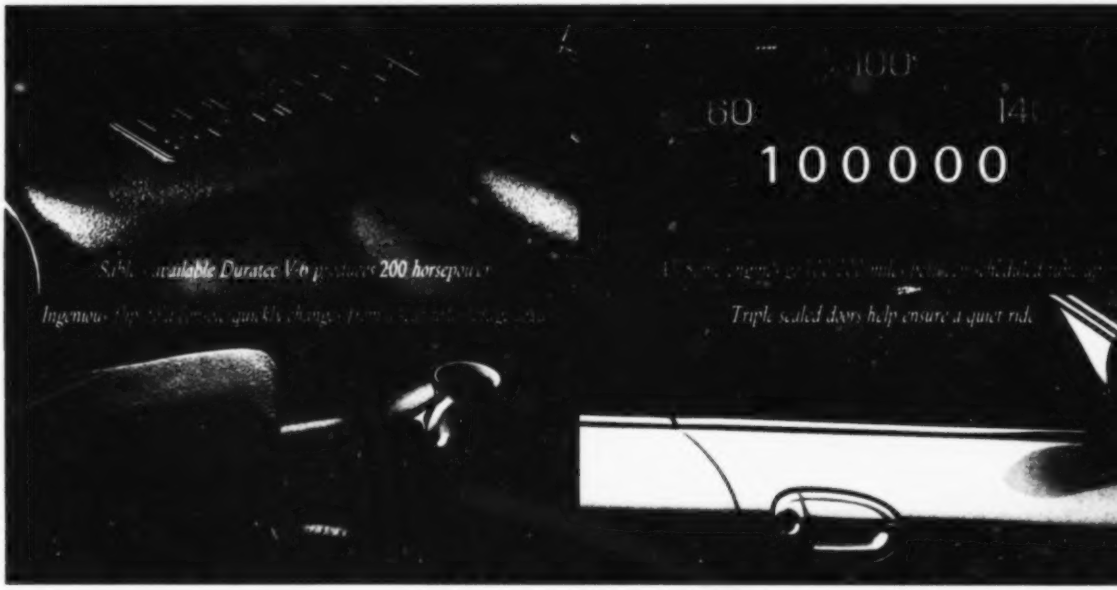

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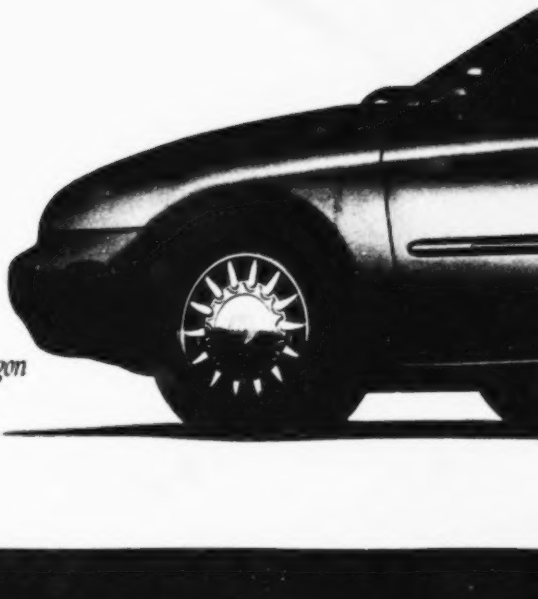

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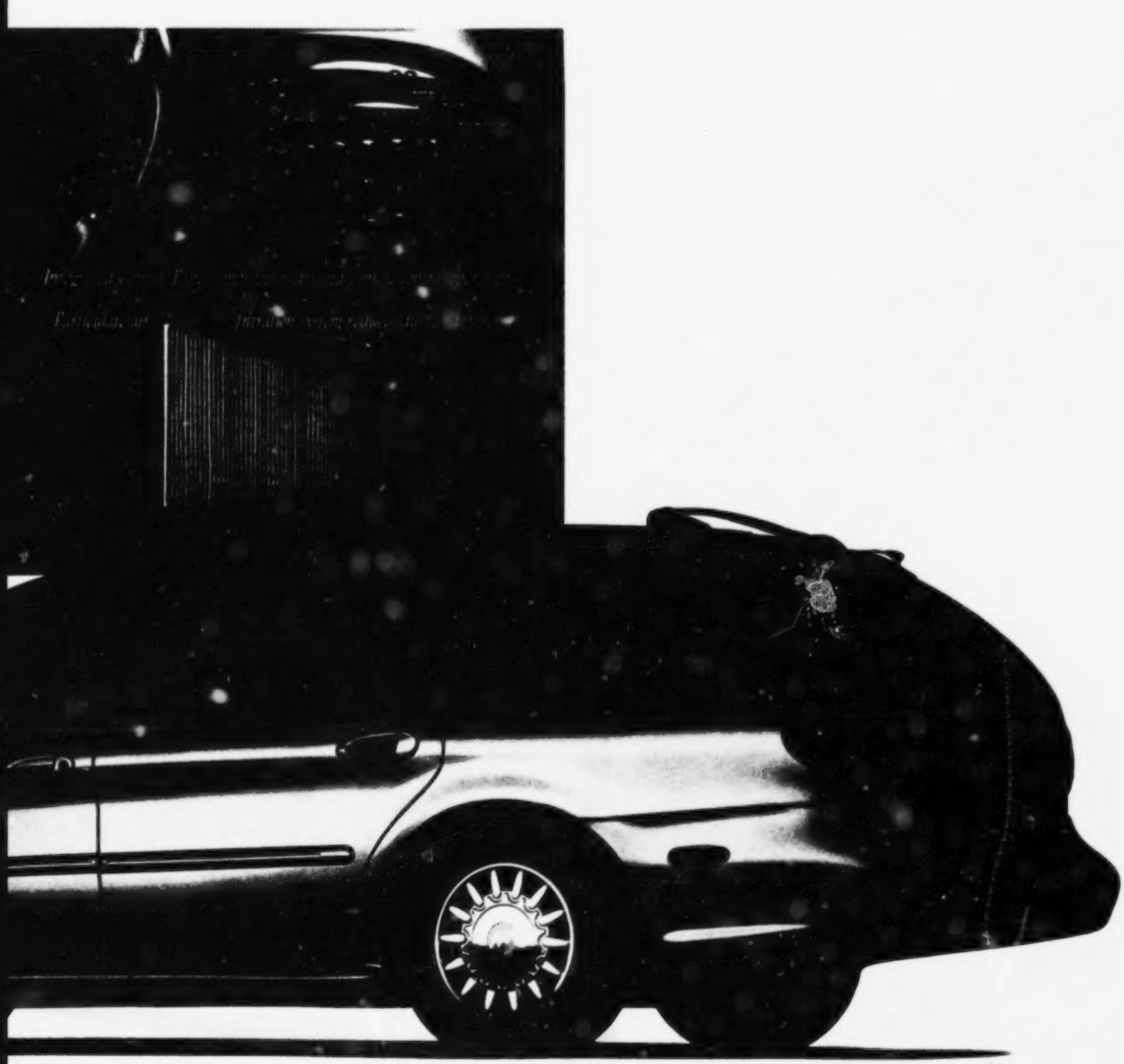

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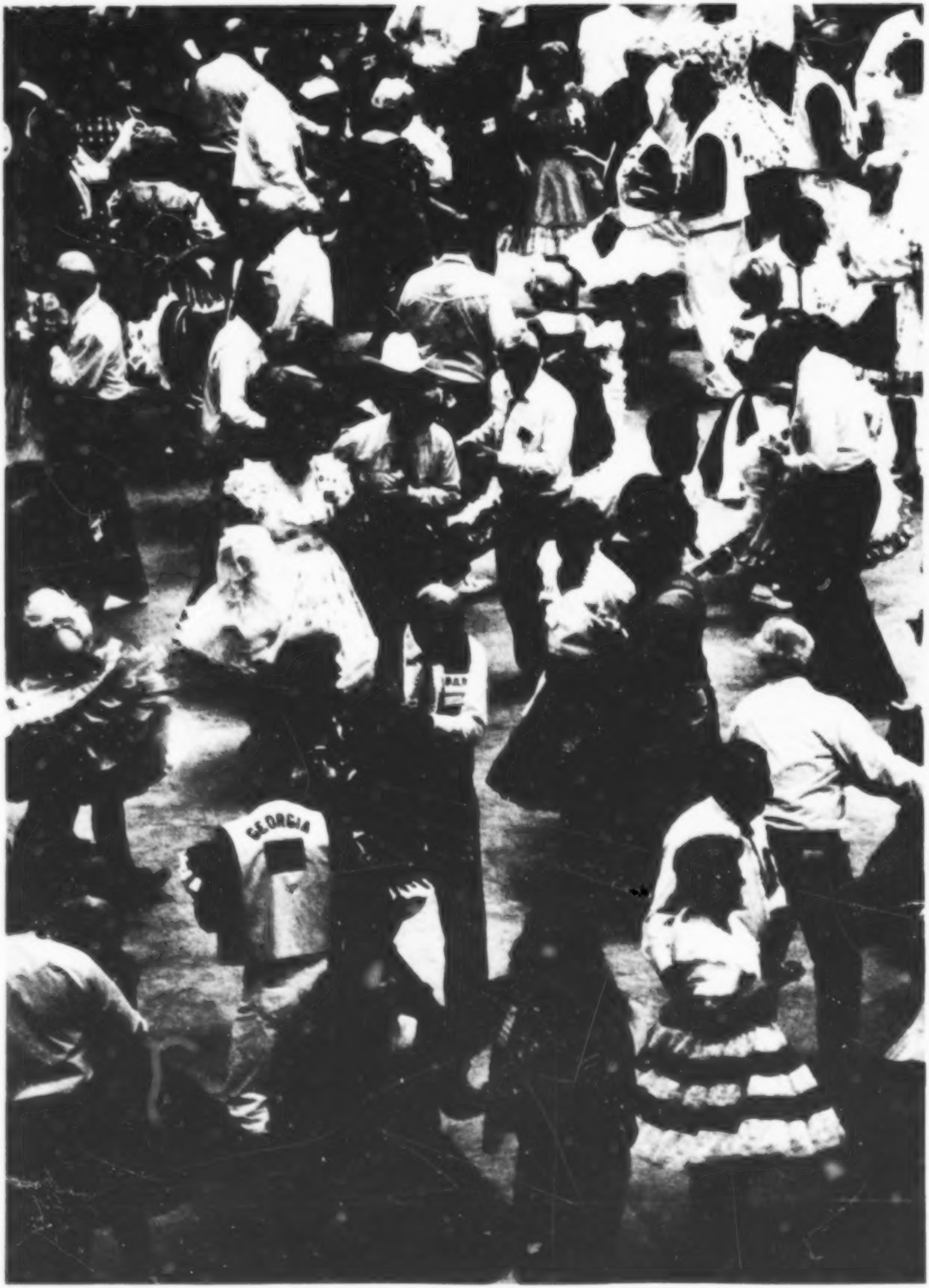

GEORGIA

By Sue Hubbell

Farewell ‘Do-si-do,’ hello ‘Scoot and counter…Percolate!’

In modern Western square dancing, you still see lots of petticoats and legs, but there are new calls, new steps and new rules

A dancer at Fosters Outback in the Missouri Ozarks flourishes ruffled petticoat. It's called "skirt work."

The 44th National Square Dance Convention, billed as "The World's Greatest Square Dancing Event," has been in full swing at the Civic Center in Birmingham, Alabama, for four days now. I find myself here as the result of a humiliation so deep I should be ashamed to reveal it in a national publication. Nevertheless, I'll start at the beginning. One Saturday evening when my husband and I were at our farm in the Missouri Ozarks, he suggested we go square dancing. He'd seen a dance advertised at a place called Fosters Outback somewhere near the town of Willow Springs. Why not? We'd learned to square dance in gym class long ago. Hadn't everyone? Couldn't we do-si-do? He put on a T-shirt and jeans. I put on a T-shirt and denim skirt and slipped into the bowling shoes that I always go dancing in because they have slick soles and jingle bells.

We drove and drove over increasingly narrow gravel roads until we came to Larry's Autobody. In back of it was a big metal building surrounded by pickup trucks. We paid the entry fee and there, inside, was a brightly lighted wooden dance floor and a snack bar with an old-fashioned portable 45 rpm record player blaring bubble-gum rock and a caller who turned out to be Larry Foster himself. The 50 or so dancers were all dressed in costume. The men wore fancy Western outfits with shirts cut from material to match their wives' skirts. The women wore ruffled peasant blouses with puffed sleeves, knee-length skirts held aloft by elaborate petticoats, lacy pettipants and high-heeled dancing shoes. Both men and women jingled with strings of metal badges from festivals, conventions and other clubs at which they had danced.

We joined in a square that was just beginning to form. Larry launched into a singsong call that had very little do-si-do in it, and we promenaded not at all. We hadn't the least notion of what we were to do and immediately snarled the dancing pattern. The others began pushing us through, first in amusement, but only at first. Panting, ashamed, badly dressed, we sat down and waited until a waltz was put on the record player before sneaking back out onto the dance floor. At the break, Reda Foster, Larry's wife, came over, kindly greeted us and explained that what we had learned to do in gym class was a modified version of traditional square dancing and that this was "modern Western square dancing."

The traditional kind, I was to learn, was performed, casually and in whatever dress one wanted, to the compelling rhythm of real fiddle music. In it, the first couple danced through a pattern while the other three couples waited their turns in the square. The caller was usually an amateur, often one of the musicians or even one of the dancers. The dance moves were easy to learn simply by watching.

Modern Western square dancing, although related to the traditional kind, is more complicated. Thousands of

Partners promenade around their squares at last summer's national convention in Birmingham, Alabama.

Photographs by Maggie Steber

1640

standardized steps and complex patterns are involved. All eight dancers, costumed according to a dress code, dance simultaneously. The music ranges from 1940s pop tunes to rock'n'roll to "God Bless America." Almost always played from 45 rpm records, it is basically for background and rhythm. The dancers respond primarily to the directions of the caller, who is usually a well-paid professional.

We had stumbled onto a whole new universe there in the dark Ozark evening at the end of a gravel road, a universe filled with people in special clothes doing special things I did not know about, and I was consumed with curiosity.

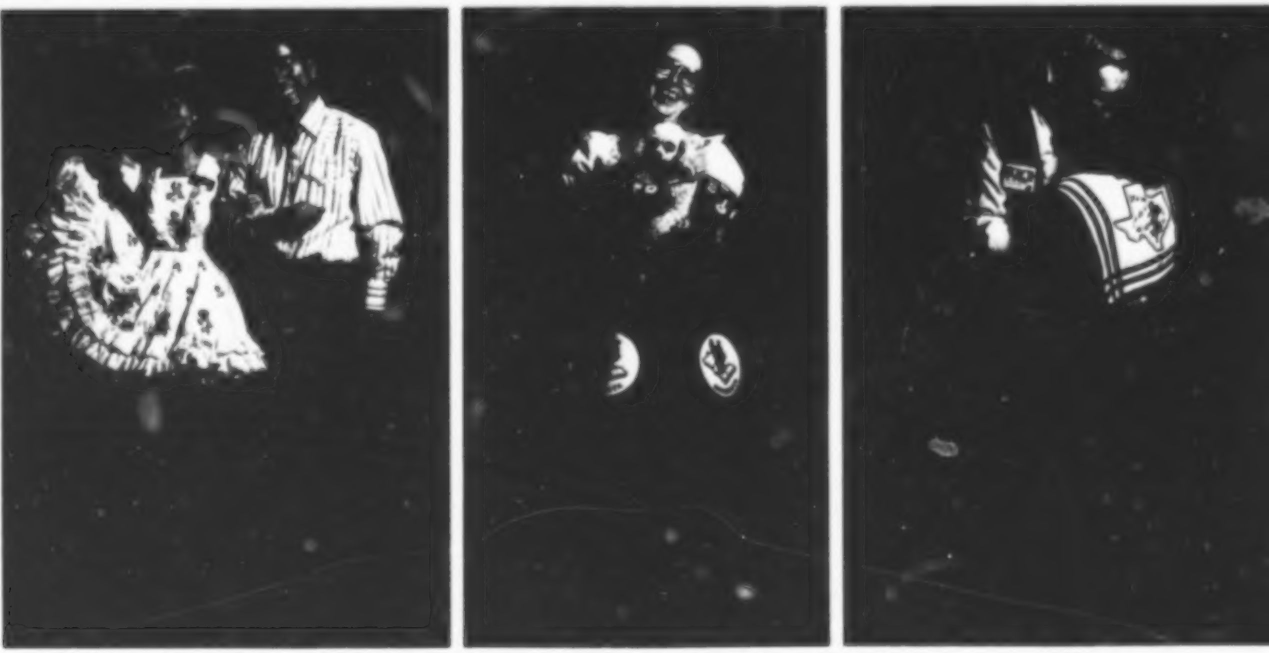
I was to discover that there are 375,000 people who belong to modern Western square dancing clubs in this country, and still more abroad. There are national and international organizations, including the United Square Dancers of America, which offers its 322,000 members an organizational focus and voice, plus educational materials, insurance and credit card services. There are also national and international events, including the one that has led me, with some stops in between, here to Birmingham.

One evening I take Joan Iverson and James Ventenbergs out to a celebratory dinner. They are grandparents from Seattle who will be married at the convention the next day, right after the demonstration by the Alabama Connection Cloggers, under the spotlights on the stage in the auditorium at the Civic Center. They met square dancing, courted square dancing and want to be married square dancing, surrounded by the thousands of dancing friends who have come to this convention.

Modern Western square dancing, also sometimes called club or federation square dancing, is performed at a variety of levels. James and Joan, a former member of the San Francisco Ballet, dance at the top level, called Challenge. After dinner I follow them into a hotel ballroom assigned to Challenge dancers, where I sit down and watch.

There are five squares of eight people each. At measured pace, their faces as fixed and intense as those of tango dancers, they follow the orders given to the "boys" and "girls," as dancers of whatever age are known, by a famous father-and-son caller team, Lee and Steve Kopman. A typical call might be just a phrase: "Unwrap the diamond," for instance. "Scoot and counter." Or, more simply, "Percolate."

Callers are the stars of modern Western square dancing; top callers can make up to $5,000 in a weekend. They choreograph a dance to bring all four couples in each square simultaneously into complex and new positions, relative to one another, and then resolve the



Among dancers at Birmingham convention are (from left) a Japanese couple; Ida Bye and Peaches from Coon Rapids, Minnesota; and an amorous pair of Texans in attire promoting the '96 convention in San Antonio.

pattern by bringing them back to their starting positions.

For the dancers it is a puzzle to be solved, for only the callers know what's going to happen ahead of time. There is an occasional whoop or frisky step, but for the most part the dancing is so deliberate that it reminds me of a chess game. Sometimes, though, callers do "singing" calls. These consist of set dance directions matched to a piece of music. Singing calls make for a more flowing dance because practiced dancers remember them and can directly anticipate the next steps.

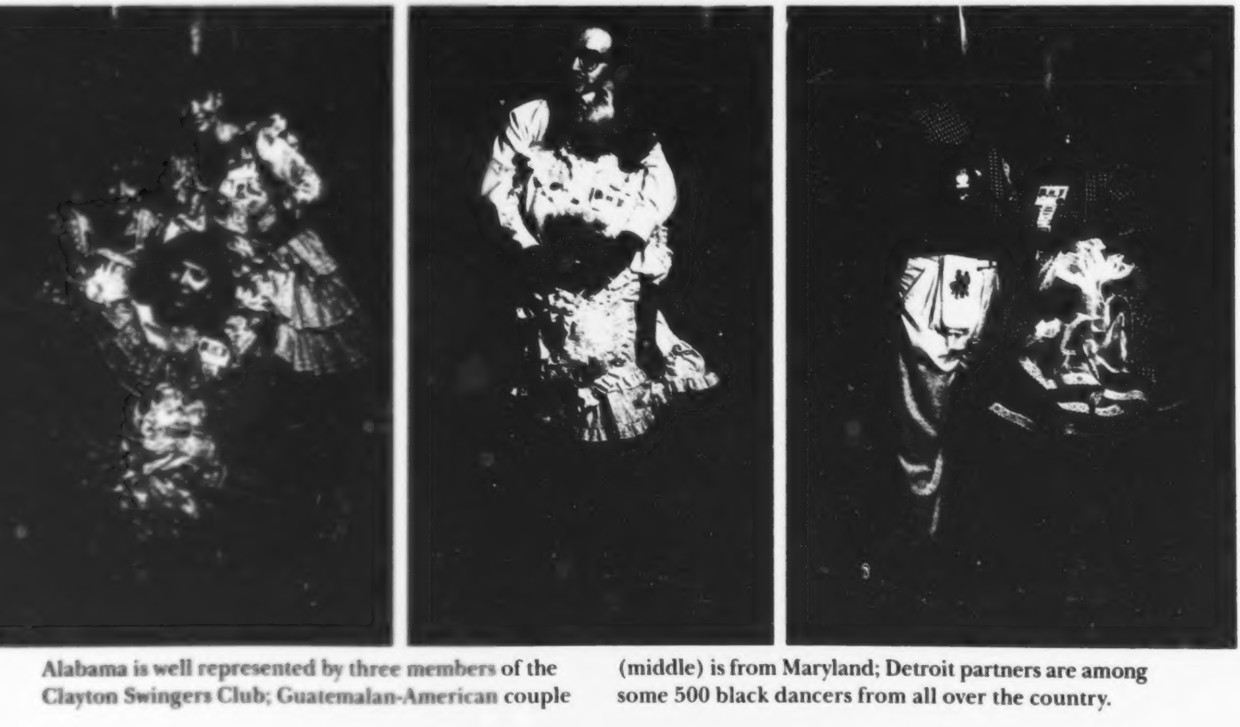
James, a thoughtful aerospace engineer, told me at dinner that the pleasure of dancing at the Challenge level is intellectual, that the dancers must know hundreds of patterns and thousands of variations on them and must respond instantly to a caller's coded phrases. "At any time," he said, "you have to keep in mind all the possibilities for the next move."

Some of the dancers in other ballrooms at the Civic Center call Challenge dancers "level snobs." They claim that they have more fun dancing at Mainstream or Plus, the first and second levels. I watch the dancers in those halls, and it is indeed true that they seem to be a jolly lot. But their pace is also a sedate one, giving time enough for a wheelchair dancer to allemande smartly around one of the squares. (Modern Western square dancers encourage handicapped individuals, who are known to them as "handicapable," to join in the fun.) But even to qualify for the Mainstream level, a couple will need at least 20 weeks of lessons (60 hours in all) to learn the basic 68 calls. Each additional level requires more lessons.

Whatever their level of achievement, modern Western square dancers are devoted. Many of the people I met at the convention dance three evenings a week, as do Joan and James, some even more. For most, their friendships and social life come from dancing.

The convention is planned by a self-perpetuating executive committee made up of previous convention chairmen. It is part trade show, part business meeting, part shopping mall, part reunion of old dancing friends. It is a convention marketer's dream: a gathering of affluent people who don't drink and get rowdy. (Drinking is forbidden by custom not only at the convention but at local club dances and smaller festivals.) One day is devoted to spirited bidding by various cities for the privilege of hosting the following year's event. The bidding is extremely competitive because the convention is such a lucrative prize. With some 13,700 dancers in town this year, Birmingham hopes to realize something in the neighborhood of $10 million.

Modern Western square dancing may be wholesome and good for the economy, but not all that long ago its



Alabama is well represented by three members of the Clayton Swingers Club; Guatemalan-American couple (middle) is from Maryland; Detroit partners are among some 500 black dancers from all over the country.

1642

Ozark fiddler Bob Holt has played fast and strong for four generations of traditional square dancers.

precursor, traditional square dancing, was considered so sinful in some parts of New England and the South that it was banned. That was due partly to its physicality and partly to the accompanying fiddle music, which was thought to be so sexually arousing that the fiddle was commonly referred to as the "Devil's box."

One day I asked Vera Toll, a woman in her 90s who lives near my farm in Missouri, if she square danced when she was young. "Oh my land!" she replied. "That's all we had to do. The dances were held in houses because some of the church people were against them. It was because of the fiddle music."

LeeEllen Friedland, a Washington, D.C. folklorist, has been gathering material on the history of square dancing for 20 years for a forthcoming book. She once asked some older dancers what they had done while they were waiting their turns. "They said that they had flirted and held hands," Friedland told me, "and that they didn't mind *that* at all!"

Gordon McCann is a native Ozarker who knows a lot about square dancing around Springfield, Missouri, where he is a businessman. He plays guitar backup for traditional fiddlers and in his younger days used to dance himself when he wasn't playing. There's a dance at one small town or another in the area nearly every Saturday evening. "In traditional square dancing," McCann says, "the music is always live."

McCann arranged for me to spend a day in Ava, Missouri, with Bob Holt (above), who has played fiddle for four generations of Ozark dancers with his own band, called the State of the Ozarks. Holt's music is faster than that played by other dance fiddlers, and theirs is faster than anything that comes from records played in modern Western square dancing. McCann had warned me that Holt's music was "nearly pagan." It does have a pounding, insistent, pulsing quality to it. It is compelling, sensual music that makes feet, including mine, dance all by themselves. Small wonder that waiting members of a traditional square dance "jig" before they come to their turn. Jigging is a kind of double shuffle to the beat of the music, and Ozark dancers develop individual styles of jigging.

Holt is a 65-year-old cattle farmer who looks a little like Abraham Lincoln without a beard. When I ask him about the emphasis he gives to the beat, he says: "My father started me playing. He was a dancer, not a fiddle

Sue Hubbell wrote on the annual butterfly census last June. Her first book, Country Year: Living the Questions, *was recently reissued by Random House.*

Sisters-in-law Nelda (left) and Lillian Gaston take a break during Saturday night dance at Fosters Outback.

The action is lively on Fosters' hardwood floor, but never rowdy. Drinking is prohibited; food is potluck.

player, but he could whistle tunes and he always insisted that I play so there'd be a place to put his foot down. And that's the way I still play."

I ask McCann how the traditional dancers he knows feel about modern Western square dancing. "I've heard them say, 'Oh we don't mind that kind of walking,'" he says with a smile.

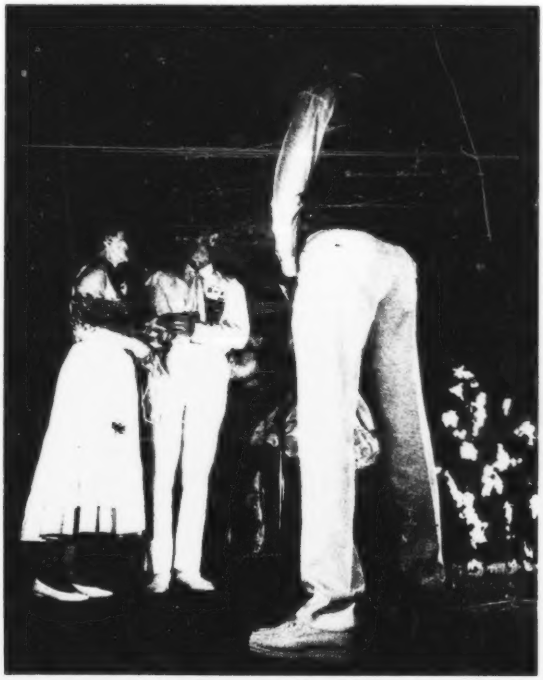
According to folklorist Friedland, square dancing has its roots in northern European dances such as the English country dance and the French quadrille. The familiar "do-si-do," for instance, is a corruption of the French expression for "back to back," *dos à dos.*

By the 1700s there were dancing masters in the Colonial United States who taught the latest European steps to the privileged few. As settlers moved westward, out to the Appalachian hills and beyond, they took dancing with them but not the dancing masters. They modified and changed the music and style, incorporating tunes and dance steps from different traditions, often inventing new ones. Villages were isolated, and so dancing, music and calls grew to be different in different places—and still are today, in traditional square dancing.

During the early part of this century, folk dancing became a fixture in many public schools. Progressive educators believed it was a good way to channel students' energies and teach them about other cultures. Initially, folk dancing meant European folk dancing, not American square dancing.

One of those much taken with the folk-dance movement was a man named Lloyd Shaw, who in the 1930s was the superintendent of a school district in central Colorado. Shaw, something of a showman, had created a folk-dance demonstration team with youngsters in his schools. At a fair one day, he saw callers putting on a square dance, something he'd never seen before. Told that it was a kind of American folk dancing, Shaw added it to his dancers' repertoire. In time he changed it to make it more interesting to watch. He developed new figures, had the boys pick up the girls to swing them, developed costumes to represent frontier dress and brought all the dancers into simultaneous action.

Shaw's troupe became popular throughout the country and performed at the National Folk Festival in Washington, D.C. in 1940. He began holding workshops and summer camps to teach others how to train dancers and remained active in square dancing until his death in 1958. "Pappy" Shaw, as he was known, is regarded by many as the father of modern Western square dancing. The Lloyd Shaw Dance Archives in Albuquerque, New Mexico, houses 50,000 square-dance-related items. I ask



Joan Iverson and James Ventenbergs, who met square dancing, take vows onstage at Birmingham convention.

its director, William Litchman, what Shaw, if he were alive today, would think of the modern Western square dancing he helped to create. "I think he would find much to disapprove of in the club dancing—the rigid rules, the long periods of lessons, the costumes," Litchman says. "But on the other hand, he would approve of it as an activity that brings people together."

Square dancing became especially popular in the late 1940s partly because people were moving a lot after World War II and it was a good way for couples to make new friends. But people who learned how to dance in one part of the country couldn't follow the calls somewhere else because the calls were different. Bob Osgood, a Californian, had for years been interested in dancing and taught classes in square dancing; in 1948 he decided to start a magazine called *Sets in Order*, the first slick national square-dance magazine. Its aim was to standardize dance moves, modify them for older dancers and discuss proper square-dance attire.

Osgood also helped establish the Square Dance Hall of Fame (now located at the Shaw Archives), and in the 1970s some members of that group set up Callerlab, a business to teach the basic calls and techniques. Based in Rochester, Minnesota, Callerlab is today the international organization for 3,000 professional callers. "When we started it, we designed it to oversee the teaching of 50 basic calls," Osgood says. "Now there are thousands of calls. There are people, of course, who think we've lost in quality what we've made up in quantity."

My registration form had advised me that "proper square-dance attire and convention badges are REQUIRED for entrance to the National Square Dance Convention." Even at 6 A.M. the hotel breakfast room is filled with dancers in full kit. There is an art to sitting down in a 140-yard petticoat, and the women manage it with aplomb. In hotel corridors, in elevators, in auditorium seats, I am buffeted by petticoats. Petticoats everywhere. To the outsider, the costumes of modern Western square dancers are the most striking thing about them. At the convention, standardized patterns and colors identify dancers by club or by state. Red-and-white outfits mean Alabama. Brown skirts with sunflowers indicate Kansas. Japan has sent a contingent (calls are learned in English throughout the world), and its members are dressed in costumes that seem to have been cut from American flags.

Uniforms aside, however, much of the square-dance attire here is wildly individualistic. A flame-haired woman from Texas shows me the zillion orange sequins she has sewn on her orange petticoat. I drift into the vendor area, a popular shopping mall of square-dance paraphernalia. Supplies, says Maine resident Allan Foster, president of the National Association of Square and Round Dance Suppliers, generate about $10 million in sales nationwide each year. He and the 85 other vendors present will do a significant percentage of their annual business right here.

There is a lot of stuff. Dresses, blouses, slacks, shirts, bolo ties. Petticoats in rainbow colors everywhere. Jackets, records, sound systems. I talk to Bill Heyman, the owner of Supreme Audio in Marlborough, New Hampshire, the largest supplier of modern Western square-dancing records. He tells me the most popular tunes range from gospel music to rock'n'roll. Even that old standby of traditional square dancing, "Turkey in the Straw," is sometimes played for modern Western dances. "But 'God Bless America' is the greatest square-dancing hit of all time," Heyman says—which just goes to show you that in the modern Western approach, the music has almost nothing to do with the dancing.

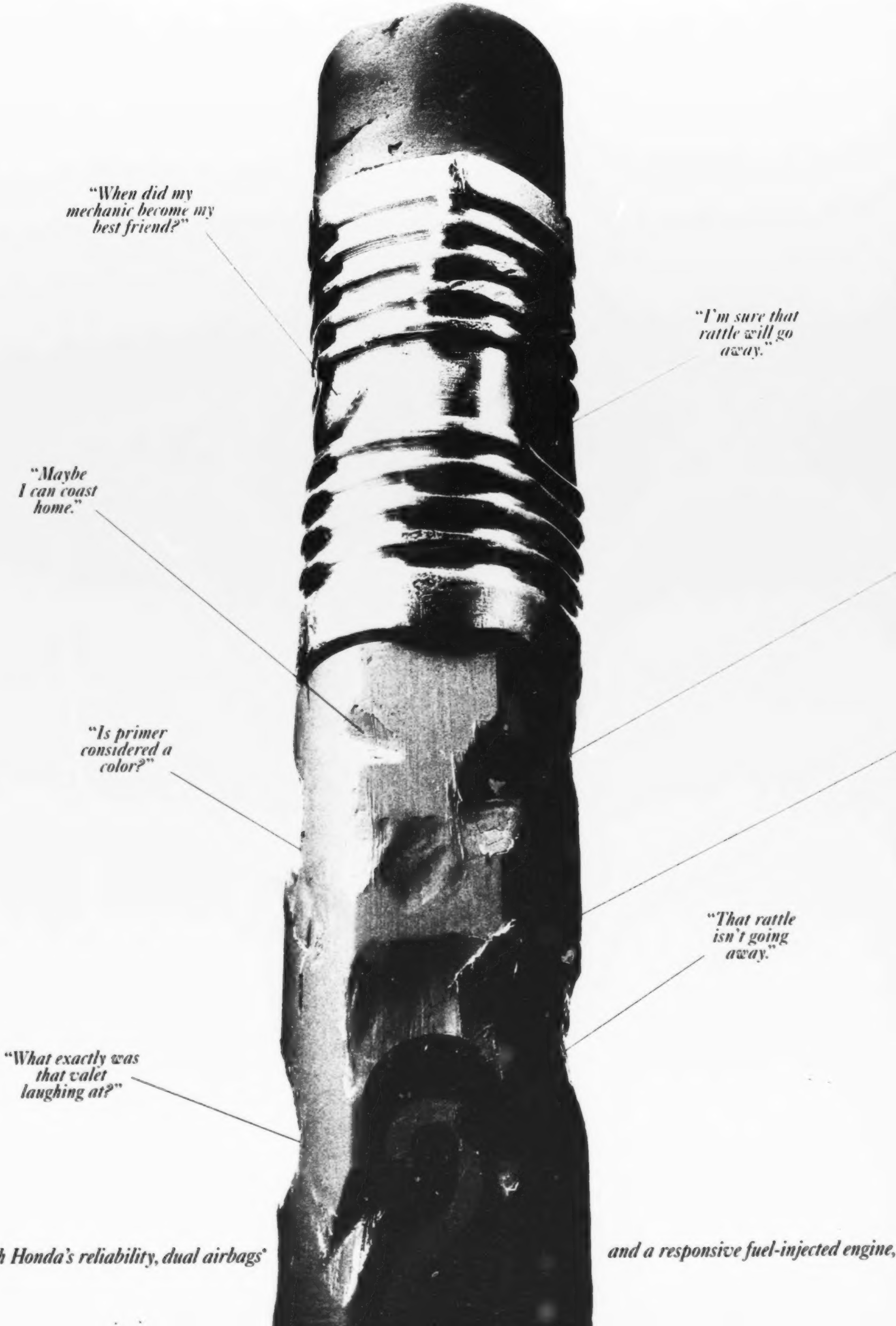
Square-dance organizations are working hard these days to recruit new members and interest younger folks because many people come to square dancing as a retirement activity. One enthusiastic group of mostly younger dancers is forming new clubs at a rapid rate. These are the gay dancers who organize under the banner of the International Association of Gay Square Dance Clubs. According to executive administrator Karl Jaeckel, who is in charge of a booth at the convention, there are 49 gay square-dance clubs nationwide with

2,500 members, and their numbers are increasing. Their dress code is casual. Many gay dancers, men and women alike, learn both the "boy" and "girl" parts and can dance either role. Jaeckel tells me he dances at the Advanced and the Challenge levels, and when I see him in action later in the day, his face is serious as he listens for calls. He is a smooth and practiced dancer.

Not long before the convention draws to a close, I meet Ida and Glenn Bye from Coon Rapids, Minnesota. They are dressed in coordinated red-white-and-blue outfits. Ida is carrying Peaches, a white toy poodle who sports a blue skirt with a red petticoat, to match. Earlier I had met caller Bob White, the proprietor, with his wife, Carolyn, of a square-dance supply store in St. Louis. He told me about the demonstration group he has formed called Do Si Dogs. It consists of trained dogs, each partnered by a human square dancer. "Dogs can't back up easily, so I had to modify the calls a little," Bob explained. When I tell Peaches and her owners about Do Si Dogs, Peaches wags her tail.

Twins Lue Lewis (left) and Sue Morris, cooling their heels between dances, find that identical costumes can cause problems. "Callers get confused," says Morris, "and guys get lost because they can't tell us apart."

*Always wear your seat belt. © 1995 American Honda Motor Co., Inc.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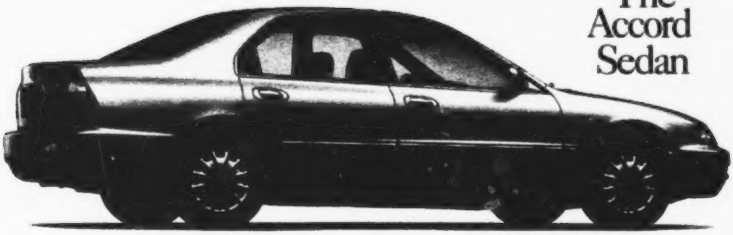

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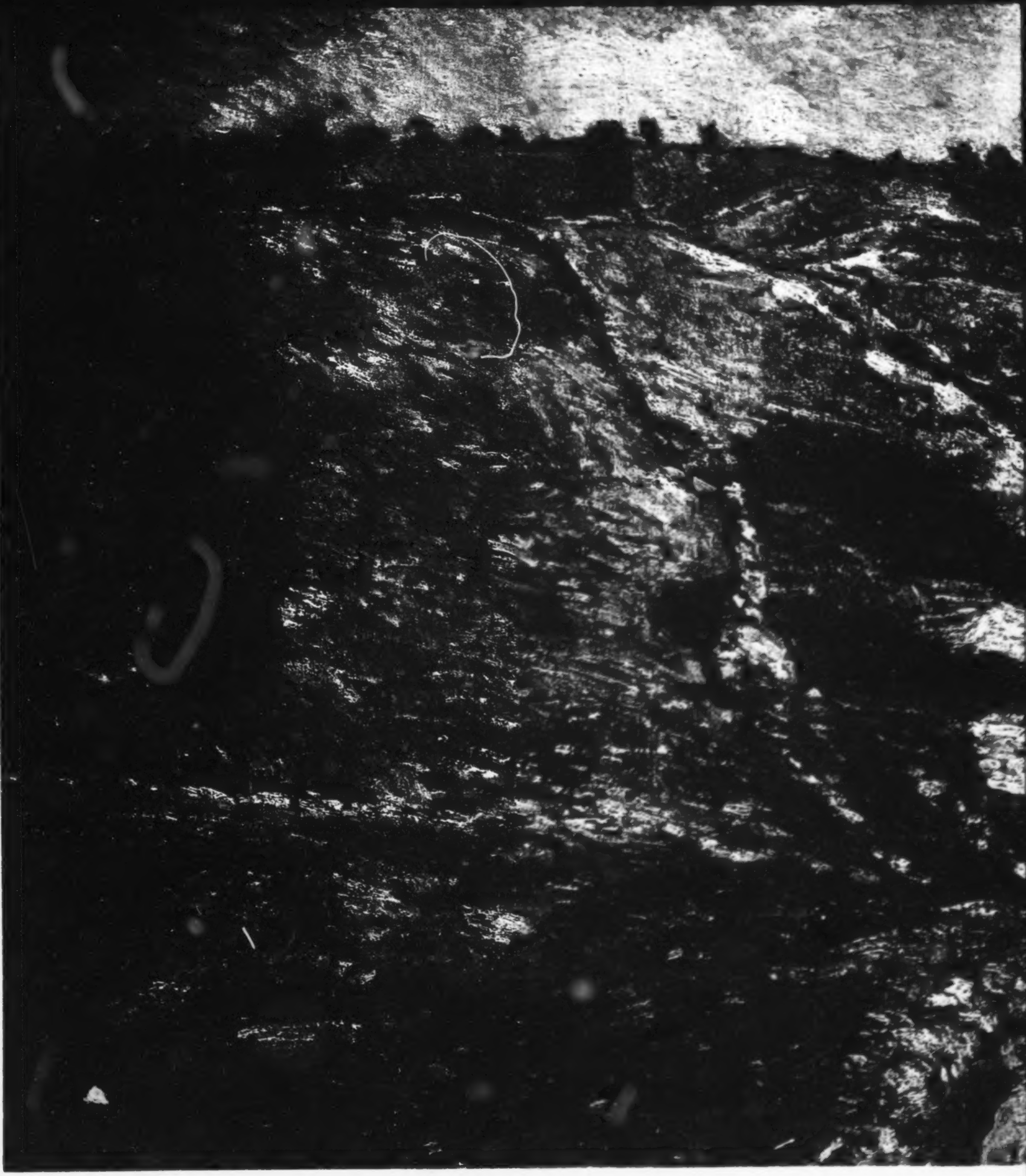
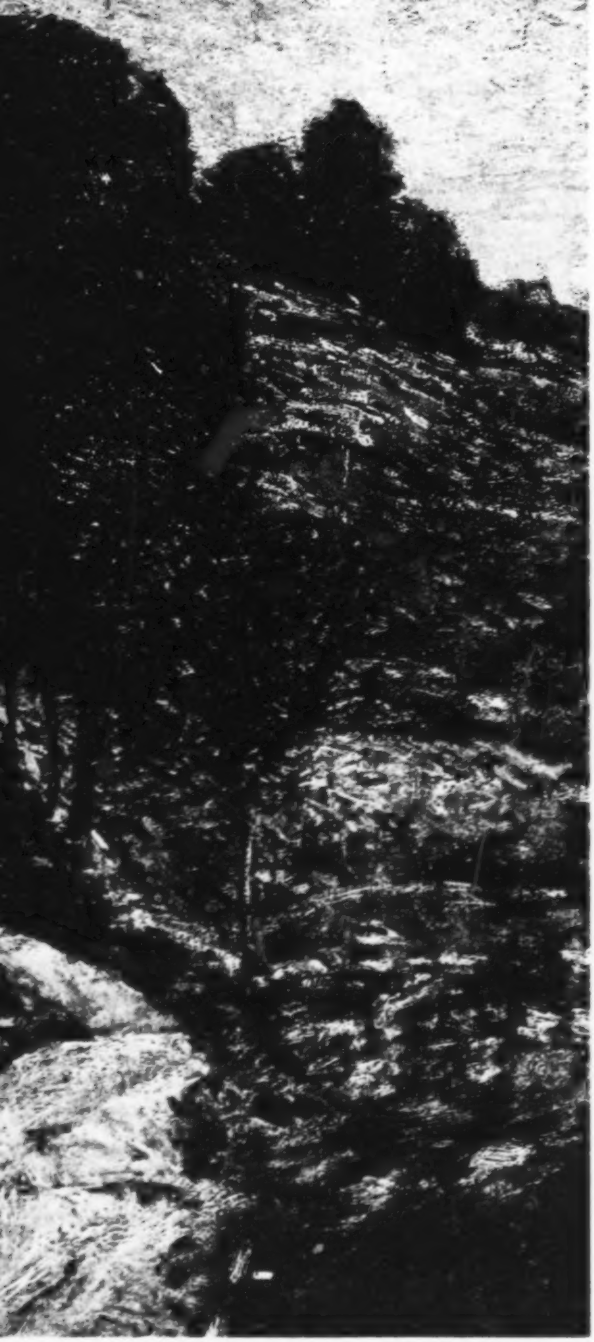


By Patricia O'Toole

Walk this trail to see what inspired the American Impressionist painters



A visit to the Weir farm in Connecticut led Childe Hassam to paint *Road to the Land of Nod* in 1910.

Bought on a whim for the price of a painting, J. Alden Weir's farm, now a National Historic Site, became a place to redefine American art

In the summer of 1882 an up-and-coming portrait painter named J. Alden Weir sent his bride-to-be a surprising piece of news from New York. He had just bought a painting for $560, and when he showed it to an art collector, the collector had made him an enticing proposition: if Weir would sell him the painting, he would pay Weir the $560 and give him a 153-acre farm in Branchville, Connecticut.

A month later, the town records show, Weir paid the collector $10 and took possession of the farm.

Nothing is known of the $560 or the painting, but the farm has proved to have a worth transcending price. It inspired Weir to take up landscape painting, and in experimenting with new styles for his new subjects, he became one of the masters of American Impressionism. His friends and fellow Impressionists Childe Hassam and John Henry Twachtman also came to the farm to paint, as did Albert Pinkham Ryder, genius of darkness and dread. Weir died in 1919, but his descendants and their artist friends have lived and created at the farm ever since. His daughter Dorothy married a sculptor, Mahonri Young, who worked there from 1932 until his death in 1957. The Youngs' friends Sperry and Doris Andrews, both painters, have occupied Weir's house since 1958. In 1990, after more than a decade of campaigning led by local citizens who believed the farm was a chapter of American cultural history worth preserving, Congress made it part of the national park system.

The Weir Farm National Historic Site offers a rare opportunity to watch a national park in the making and an even rarer opportunity to step into the world of an artist. "Weir Farm is the only intact home, studio and landscape of American Impressionism, and the landscape was critical to the painting produced here," says park superintendent Sarah Olson. The home of 19th-century sculptor Augustus Saint-Gaudens in Cornish, New Hampshire, is the only other national park devoted to the life of an artist.

The life of Julian Alden Weir began on August 30, 1852, in West Point, New York. The 13th of 16 children, he grew up in a household filled with art and artists. His father, Robert W. Weir, was a painter of sufficient distinction to win a commission to paint a mural, *The Embarkation of the Pilgrims*, for the rotunda of the U.S. Capitol. Robert Weir also taught drawing at the United States Military Academy. Among the cadets who polished their draftsmanship in his classes were Ulysses S. Grant, William Tecumseh Sherman, Stonewall Jackson and James Abbott McNeill Whistler.

As a boy, Julian hunted and fished along the Hudson River. He also painted, drew and talked about art with his father and older half-brother, John Ferguson Weir, a future painter and the first director of the Yale School of Fine Arts.

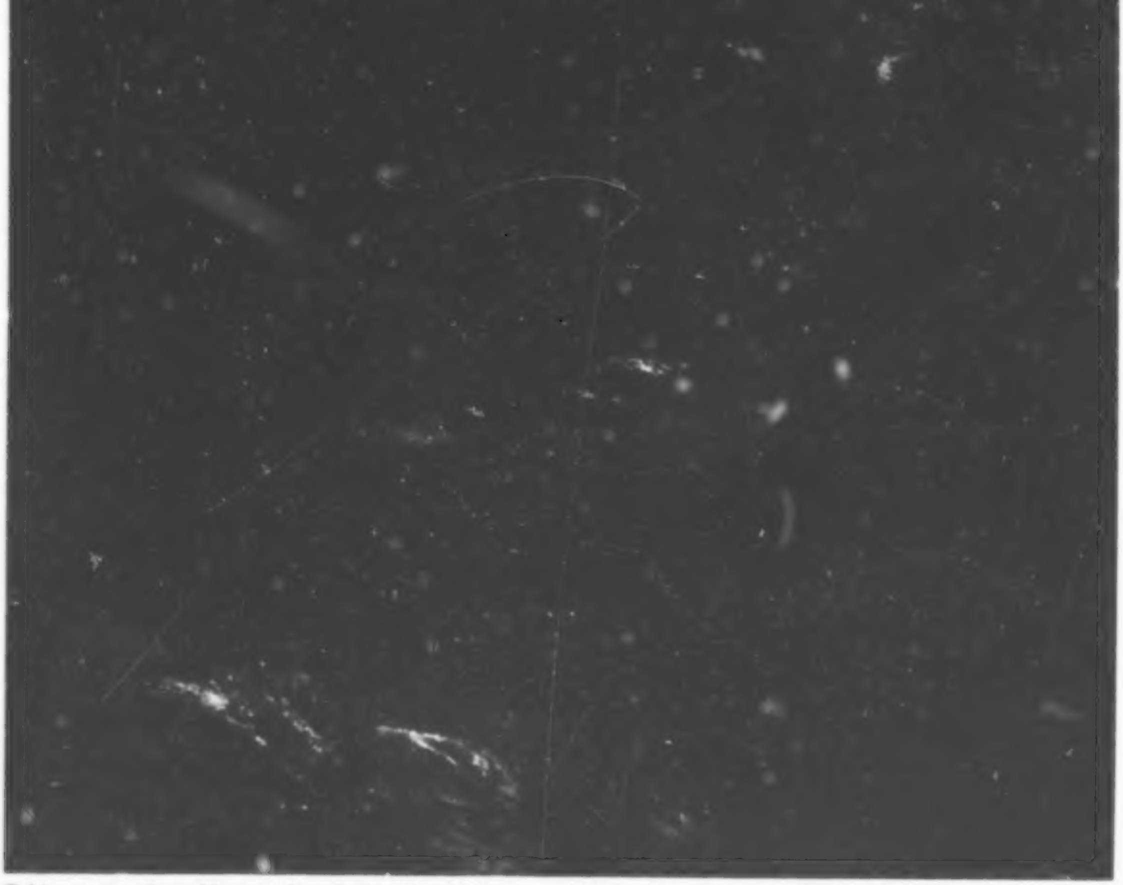
At 18, Julian began studying at the National Academy

Photographs by Michael Melford

1650

Weir Farm has not changed much since J. Alden and Anna Weir first lured their artist friends out to the country in the 1880s. Among frequent visitors were Childe Hassam, John Henry Twachtman and Albert Pinkham Ryder. Photographs at top show the farm as it looks today. Below them are paintings of the same scenes, done more than a century ago. They are, from the left, *Weir's Orchard*, painted in the late 1880s by Ryder; *In the Livingroom*, a portrait of Anna by Weir in about 1890; and, also by Weir, *The Laundry* (1894), with a view of the main house. Modern-day visitors to the farm can now carry a brochure along a mowed path and compare 12 artworks with the scenes that inspired them.

1652



Taking a page from Monet, who often worked in his houseboat-studio at Giverny, Weir had his "Palace Car" (shown here in a painting by him). A portable outdoor studio complete with stove, it sat on long runners.

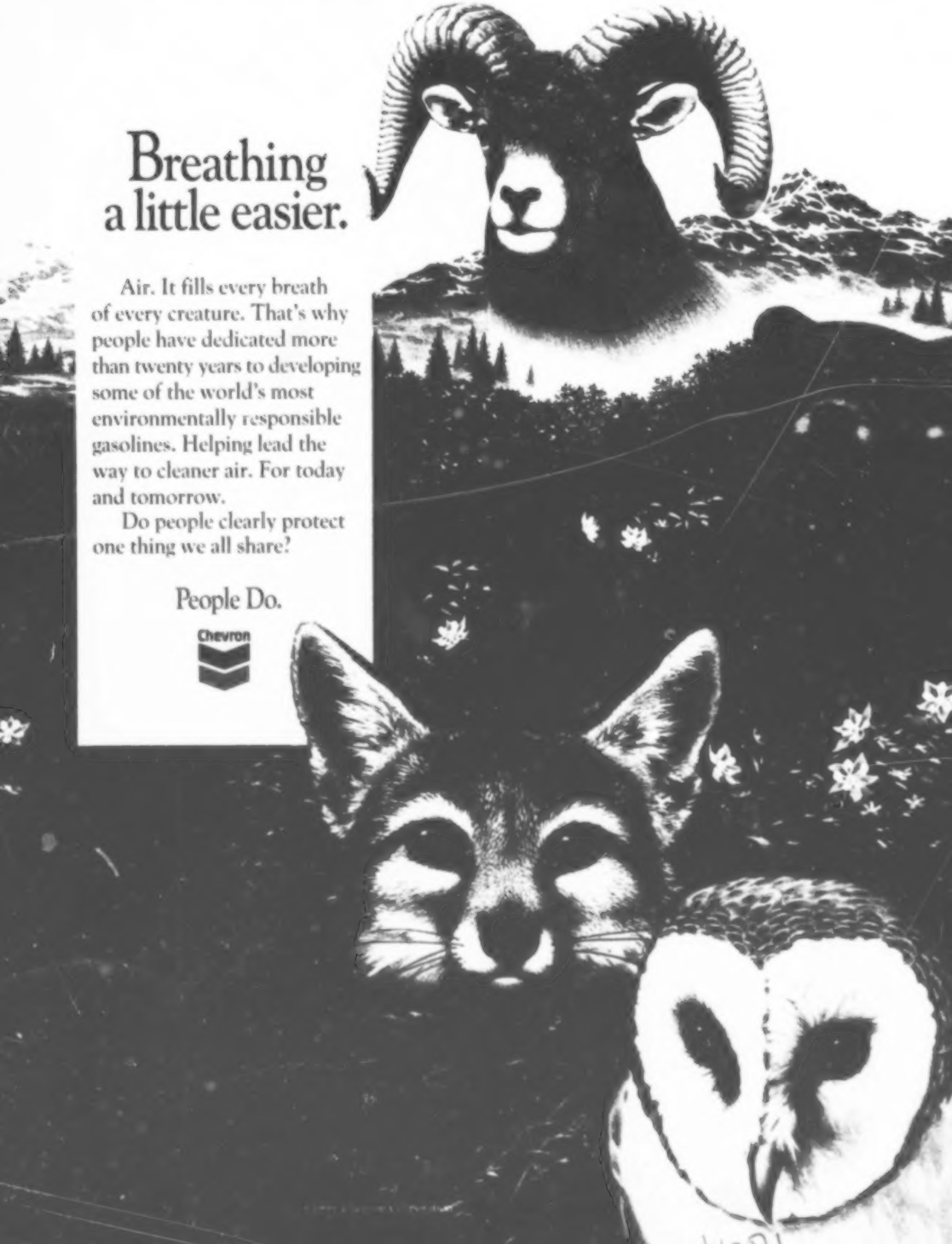
of Design in New York City, and at 21, he went off to Paris to train under Jean-Léon Gérôme at the Ecole des Beaux-Arts. Four years later, nearing the end of his stay, he had his first encounter with Impressionism: "I went across the river the other day to see an exhibition of the work of a new school which call themselves 'Impressionalists,'" he wrote his parents in the spring of 1877. "I never in my life saw more horrible things. . . . They do not observe drawing nor form but give you an impression of what they call nature. It was worse than the Chamber of Horrors. I was there about a quarter of an hour and left with a head ache, but I told the man exactly what I thought. One franc entrée. I was mad for two or three days, not only having paid the money but for the demoralizing effect it must have on many."

The outburst was memorable not only because Weir eventually embraced Impressionism but also because it was at odds with his usually sweet temper. Easygoing and gentle, he made friends everywhere.

When Weir returned from Paris, he rented a studio in Greenwich Village and began seeking commissions for portraits and giving painting lessons. Although teaching robbed him of time for his own work, it brought interesting pupils, including Frederic Remington, whose depictions of the American West would mythologize the cowboy, and Anna Baker, a beautiful 19-year-old with violets tucked in her belt. Weir waited as long as he could—three weeks—and proposed.

Julian and Anna married in 1883, stayed for several weeks at the farm and then sailed for Europe. They came home early partly because Julian was worried about money but also, he said, because they were lonely for "the quiet plain little house among the rocks" in Branchville. They settled into a routine of living at the farm from spring until late fall and spending the rest of the year in Manhattan. In the New York art world of the 1880s, Weir enjoyed the respect of the old guard and the affection of Ryder, Twachtman and other young artists heading in more daring directions. In addition to doing commissioned portraits, Weir often painted his wife, sometimes with the first of their four children, Caroline, who was born in 1884.

Some of these family paintings were done at Branchville, but before 1889 Weir rarely painted the farm itself.



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His shift to landscapes and a more suggestive style, with the light palette and broken brushstrokes of the Impressionists, seems to have grown out of a frustration with old approaches. "Traditions are good things and interesting," he told his half-brother, John, but he felt the conventions of the day had misled him into trying to "see through the eyes of greater men" rather than to explore the "character and aspect" that interested him most. "I was hampered by trying to render the things I did not see and unable to get at the things that really existed." A critic derided the "spinach-like texture" of Weir's brushwork, and patrons of the gallery that showed his new pictures refused to buy. He was undaunted. "My eyes, I feel have been opened to a big truth and whether or not I can develop in that direction I know not, but one thing I do know is that painting has a greater charm to me than ever before."

Eager not to miss a day of painting outdoors at the farm, Weir in 1890 designed a little portable studio, a hut on runners. Grandly dubbed the "Palace Car," it could be dragged by oxen to wherever he wanted to paint. Windows in all four walls gave him views in every direction. A stove kept out the cold.

The idyll was broken only twice: in 1889 by the death of his infant son, Julian, and in 1892, when Anna, then 29, died after giving birth to their third daughter. The following year he married Ella Baker, Anna's sister, who had been caring for the Weir children since their mother's death.

Weir painted more than 200 pictures at the farm, and together they form a portrait of his contentment. Warm, contemplative, domestic, they show sunny pastures, boulders, a stand of birches, the flower garden and his pond, which he built with a $2,500 prize from the Boston Art Club. Like Weir himself, the paintings are soft-spoken, engaging the viewer more by invitation than command. His son-in-law, Mahonri Young, noted that Weir's paintings had no "tempests and few storms."

He liked to paint until 3:30 in the afternoon and then head for the woods to hunt. His partridge, quail and woodcock regularly turned up on the dinner table; the farm, worked by a caretaker, produced livestock and grain. It also kept the family in potatoes, apples and cider. Weir's life at the farm, said John Singer Sargent, was "the finest life I have ever seen."

On first seeing Impressionist works, Weir, here at the farm, compared them to the "Chamber of Horrors."

Weir's friend John Henry Twachtman followed him to Connecticut in 1886, renting several houses before settling in Greenwich. Their rural isolation was "a fine thing," Twachtman told Weir, because it put an artist "nearer to nature." Like Weir, Twachtman was a seeker of private essences. He narrowed his color range to highlight the geometry of his compositions and often left out the horizon to focus the eye on a small scene. He also painted the same waterfalls and brooks again and again, hoping to come closer to their truths.

The author lives a few miles from Weir Farm. Her book, The Five of Hearts, *which was nominated for a Pulitzer Prize, was excerpted in the June 1990 issue.*

Twachtman was a regular at the farm and, after 1890, so was the effervescent Childe Hassam (Smithsonian, December 1990), whose bold colors make his work more immediately accessible than Weir's and Twachtman's. When Hassam came to Branchville, he and Weir were inseparable. They painted all day in the fields and played dominoes deep into the night. Enchanted by the farm's address, Nod Hill Road, Hassam turned this piece of serendipity into a green reverie he called *Road to the Land of Nod.*

Weir had a special fondness for the reclusive Albert Pinkham Ryder (Smithsonian, May 1990), who painted the terrors of death, witches and Jonah's ordeal with the whale. Weir lured Ryder to Branchville by outfitting a guest room with an exterior door, enabling him to slip in and out without meeting anyone. On one visit, Ryder

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Sarah Olson, superintendent of Weir Farm, stands in front of one of the recently restored garden gates.

managed an almost cheery painting of Weir's orchard. Grateful as Ryder was for Weir's hospitality, however, he confessed after one visit that he preferred walking the city at night to drowsy afternoons of fishing in the pond: "Catching mice is more in my line, and they are shivery looking enough for me."

At the end of 1897, Weir, Hassam, Twachtman and seven other established painters seceded from the Society of American Artists and organized as the Ten American Painters. They meant to go quietly, wanting nothing more than the opportunity to exhibit together, away from the hodgepodge that the society's big annual exhibition had become. But the split set off charges and countercharges, and "That Row among Artists," as one newspaper called it, was the talk of New York for weeks.

Although The Ten's first show, held in April 1898, met with enthusiasm, the eight canvases shown by J. Alden Weir did not. "They touch the sympathies lightly, and then, in some curious way, they leave one cold," said one critic. Others have felt likewise, put off by the roughness of the artist's deliberately rudimentary forms. But as the painter's daughter Dorothy Weir Young observed in *The Life and Letters of J. Alden Weir,* Weir cannot be appreciated unless he is approached on his own terms: "He disliked having everything taken in at a glance, preferring instead that things should disclose themselves gradually, when one was least expecting it."

The Weir Farm National Historic Site discloses itself as gradually as the paintings. Perched atop a hill on a quiet country road, it first seems to be a classic New England farm—a collection of barns and houses in dark red with white trim, all neatly set in pastures crisscrossed with stone walls. Only a walk around the grounds reveals that two of the "barns" are studios, one built by Weir, the other by Mahonri Young. (A grandson of Brigham Young's, Mahonri is best known for *This Is the Place,* an ensemble of 20-foot bronze figures and bas-reliefs marking the spot overlooking the valley of the Great Salt Lake where Brigham Young decided the Mormons would settle.) Weir's beloved pond is invisible to passers-by, reachable only by a footpath through the woods. "People who come to Weir Farm discover the place on their own," says Gay Vietzke, chief of visitor services. "My sense is that that's what Weir wanted." (Open Monday through Friday during the winter, the farm will open seven days a week after April 1.)

The park owes its existence to neighbors and friends who formed the Weir Farm Heritage Trust and staved off suburbanizing bulldozers. To succeed, they had to win the support of preservation groups, the towns of Ridgefield and Wilton, the state of Connecticut and, ultimately, Congress. The National Historic Site occupies 60 acres, which are adjoined by 113 acres owned by the Nature Conservancy, 86 acres by the state and 33 acres set aside as open space by the town of Ridgefield. (Branchville, little more than a railroad stop, is part of both Ridgefield and Wilton.)

Horticulturists, environmentalists, archaeologists and specialists in the preservation of buildings and landscapes have worked with Superintendent Olson to plan the park's future, assess the condition of the buildings and the natural resources, and inventory the contents of Weir's studio and other buildings. A recent find: a pair of big wooden runners that may have been the underpinnings of the Palace Car. One of the first additions for the public was a painting-sites trail. Brochure in hand, visitors can follow a mowed path and compare reproductions of 12 paintings with the scenes that inspired them.

"Don't stop now. Keep the art alive"

Park rangers keep pastels and sketch pads handy for visitors who want to draw but arrive unequipped. People also come to picnic, bird, fish and hike. "In the early stages of developing a general management plan, we invited artists, art historians and art educators to workshops so we could find out how they thought the site should be used," says Marjorie Smith, a landscape architect and park planner who works in the National Park Service regional office in Boston. "The artists told us, 'This site has inspired artists for over a hundred years. Don't stop now. Don't make it a museum piece. Keep the art alive.'" That conviction has generated art classes, a lecture series, school field trips and the creation of a visiting artists program, which is administered by the Weir Farm Heritage Trust.

The only thing noticeably scarce at Weir Farm is the artwork of J. Alden Weir. "We think it's important to have an art collection here because there is nowhere else in the country for the public to see the art and its landscape together," Olson says. "But we don't have the security or the temperature and humidity controls that museums can provide. And the money for the collection will have to come from private sources because the legislation that created the Weir Farm National Historic Site prohibits us from spending federal funds on art." Fundraising for a collection will be led by the trust.

Volunteers from the Ridgefield Garden Club are restoring the farm's flower garden, untended for decades and overrun with trees. "The sundial was missing, the pedestal was crumbling, the arbor gates were gone," says Eliot Foulds, one of the historical landscape architects brought in as consultants from the National Park Service's Olmsted Center for Landscape Preservation in Brookline, Massachusetts. "We removed the nonhistoric trees and looked at old photographs to determine what had actually grown there. To identify climbing vines, we took the photos to experts at the Arnold Arboretum of Harvard University." The garden was replanted in 1995 with flowers found in the photographs, including moss roses, phlox, asters, peonies, lilies, irises, coreopsis, delphiniums and cosmos. The garden club is also restoring the boxwood ring that grew around the fountain. The old ring could not be saved, but it provided cuttings for propagating a new one.

There is a soul-satisfying symmetry in the fact that the quaint, plain little house among the rocks has so many friends. An excellent friend himself, Weir once saw Albert Pinkham Ryder through a hard time by selling a painting Ryder had given him and passing along the proceeds. When John Henry Twachtman died at 49, it was Weir who organized a sale of Twachtman's work that raised $16,610 for his family. "You can feel his warmth here," says park planner Marjorie Smith. "I think that's why so many people have helped care for the place." J. Alden Weir led a fine life, as John Singer Sargent said. Thanks to his new friends, it goes on.

The legendary warmth of J. Alden Weir permeates his studio, still filled with his tools and brushes. The three paintings at left are Weir's only works at the farm, but supporters are hoping to change that.

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By Bruce Watson

A Freedom Summer activist becomes a math revolutionary

In the Algebra Project, Robert Moses uses subway rides, gumdrops and everyday experiences to help kids cope with exponents and negative numbers

On a warm Saturday morning in spring, a bunch of rowdy sixth-graders take over a gymnasium in Cambridge, Massachusetts. Shouting, daring, flashing their white tennis shoes, teams warm up, then take their best shots in an elimination tournament. The Longfellow School edges the Agassiz School in a tough game, then faces the King Open School for the title. Parents, coaches, teachers, fans, are up and screaming as the lead goes back and forth. Then, in the final minute, King Open huddles up and runs a pattern play across the gym floor. Whipping out their pens, they factor numbers from 1 to 200 into primes and tape their answers to a matrix spread on the hardwood floor. Referees shout "Correct!" and King Open storms off the bench with the city championship . . . in algebra.

Across the country, abstract math is hitting the concrete. From Chicago's South Side, students ride the El downtown, turning the trip into a number line of positive and negative integers. In Indianapolis, students give a two-hour algebra workshop for their parents. In Boston, kids who once groaned through math now get introduced to the concepts of algebra at an early age. In each city, the common denominator is the Algebra Project, the mission of a man who knows both math and movements.

The last time Bob Moses organized a movement, he was called a Communist and an "outside agitator." His cause then was as basic as 2 + 2. He wanted everyone to vote. But this was Mississippi in 1961, where whole counties with black majorities had no registered black voters, and there were those who would seemingly stop at noth-

Photographs by Ron Ceasar

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In a combined relay race and math contest, Brinkley Middle School sixth-graders solve a problem, run to the board, run back to teammates.

ing to keep it that way. During three explosive years, Moses' serenity in the face of beatings and arrests made him a legend in the civil rights movement. In 1964 his tactical organizing made history during Freedom Summer, which focused national attention on Mississippi's "closed society." But when he left "the movement," Moses took up his old job: teaching math.

Now Bob Moses is organizing again. His goal is to help kids meet new demands for successful citizenship. "The idea of citizenship now requires not only a reading-writing tool, but a math-science tool," Moses told members of the Mathematical Association of America in Washington, D.C. "Math literacy and economic access are how we are going to give hope to the young generation."

Since 1982, when Moses won a "genius grant" from the MacArthur Foundation, the Algebra Project has been lifting students onto the launching pad toward college-prep math. It now reaches some 45,000 sixth-, seventh- and eighth-graders in 105 schools in inner cities and the rural South. The project's aim is to open up the access to an exclusive club. Only 11 percent of all high school students climb math's
ladder from algebra through calcul
Moses notes. The rest, ready or n
enter a high-tech economy where mi
imal math can equal a minimum-wa
job. "Every school needs to focus
how to put a floor under all student
he says. "In the Algebra Project we d
fine the floor as preparation to do c
lege-prep math. That doesn't mea
every student will go to college, b
every student should be ready."

To the Arabs who helped advance
algebra provided a means of grappli
with unknowns. The word itself mea
"the uniting of broken parts to resto
a whole." But for Moses' young st
dents, his project is part algebra, pa
alchemy. It turns ratios into recipes f
lemonade and transforms the slipper
ness of exponents into the stickiness
gumdrops. Many school progran
offer hands-on activities, but the A
gebra Project, like Moses himself,
rooted in logic, experience and gras
roots democracy.

At the Brinkley Middle School
Jackson, Mississippi, Bob Moses stan
in a classroom with bags of gumdro
in his hands. The seventh-graders b
fore him know little of his role in h
tory. To them, he is Mr. Moses or M

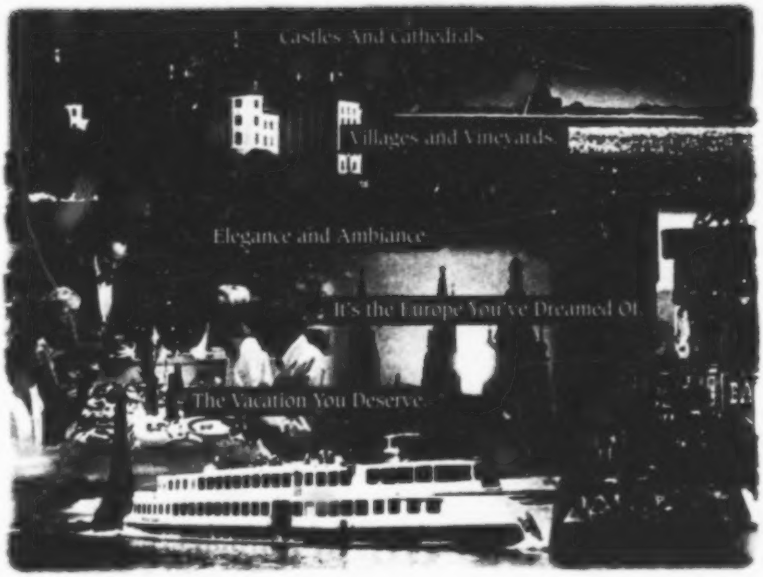
ob, the teacher who lets them play at ath. Only when they switch to history ill they learn how the man with the ath games risked his life to open eir society.

Down in Mississippi in 1961, few had een anyone like Bob Moses. As field ecretary for the Student Non-Violent oordinating Committee, he was shy et frank, absolutely fearless, utterly elf-assured. In Liberty, leading two hen to the registrar of voters, Moses as beaten with a knife handle. Bleedng heavily, he got the men to the regisrar, then pressed charges, something lacks just didn't do in Mississippi's closed society." Word soon spread mong civil rights workers. Though he ore bib overalls, this Moses had a aster's in philosophy from Harvard. I just didn't understand what kind of uy this Bob Moses is," a SNCC worker aid after Moses nonchalantly took a ap in an office just ransacked by a nob, "so I guess I was learning."

Raised in Harlem, Moses won scholrships to competitive high schools nd college in the 1950s. He entered Harvard's doctoral program in philosphy, then dropped out because of his nother's death and his father's illness. But in 1960, while teaching math at he Horace Mann School in New York, e read of sit-ins at segregated lunch ounters in North Carolina. "They vere kids my age, and I knew this had omething to do with my own life," he emembers. Moses spent the next summer in Georgia, working with veteran rganizers like Ella Baker. Following nother year of teaching, he went outh again and stayed for three years.

Three decades later, Moses is back n Mississippi, testing Algebra Project ctivities for seventh-graders. In the lassroom, as in the line of fire during is hot summers here, Moses, now 61, s somber, serene, riveted to his task. Though his name may be Moses, he as the patience of Job. Faced with ten tudents behaving like random num-

Bruce Watson's SMITHSONIAN *articles eport on topics ranging from the Peace Corps to Navajo Code Talkers.*



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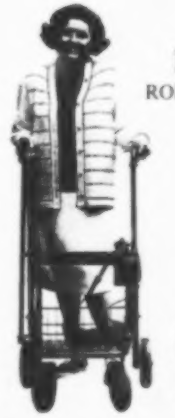

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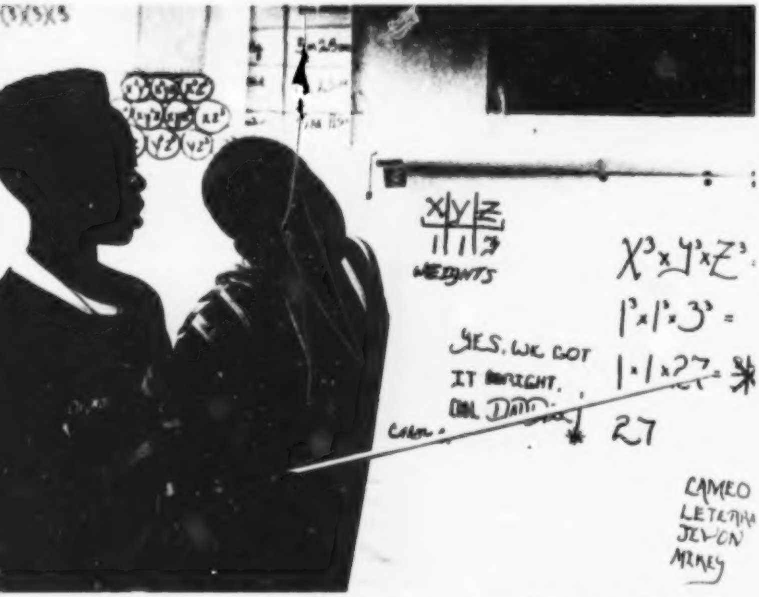
bers, he calms them with his presence, speaking so softly that, as one Freedom Summer volunteer recalls of his manner all those years ago, "he seemed to be addressing each one separately, though talking to no one at all."

"Now you remember we agreed that there's no learning unless you decide you're going to learn something," he tells the students. "If you have another agenda, you can't learn the math." He pauses, staring until the walls themselves seem sobered and ready to learn. "All right, can we begin?"

Few math teachers demonstrate exponents with gumdrops, but Moses is a prime number among teachers, divisible only by himself. Stressing that the candy he is passing out is for "mathematical purposes only," Moses begins constructing concepts in youthful minds. He sticks one toothpick between two gumdrops, then sets it aside. He builds a toothpick-gumdrop square, then a cube. If $a = 1$, he explains, the single toothpick is simply a. So what would the 1 x 1 square be? Students guess for a minute until one shouts "a^2!" And the cube, a x a x a, is? "a^3!" someone shouts. He makes other models—a rectangle, 1 x 2 toothpicks, a rectangular solid, 1 x 1 x 2. If the two-toothpick side is called b, then the rectangle will be? "a x b!" After further discussion, Moses sets students free to build their own models of these "algebra forms." When the bell rings, a few gumdrops have mysteriously disappeared. But for 45 minutes, kids have created models for the exponents they will use every day in algebra.

Shortly after a handful of teachers introduced the Algebra Project at Brinkley, principal Ken Acton noticed a hole in his morning schedule. The same tough kids sent to him day after day for cutting up were no longer in his office during math class. "I see almost no one from the Algebra Project for disciplinary reasons," Acton says. "They're too busy with the activities." He estimates that discipline problems in the project's classes have dropped by 90 percent. The Project's other numbers are equally encouraging. In 1992 only 22 of 200 Brinkley eighth-graders took algebra. This fall, as the Project's first veterans move into eighth grade, 130 out of the 160 members of the class will be headed through algebra's gate toward higher math. Acton points proudly to the school's annual Achievement Tests, where project veterans scored 13 na-

Mariama Gibbs (left) and Erica Thomas explain a display to teacher Lynne Godfrey at a workshop where faculty evaluated the students' success.



After working out a solution to a problem, seventh-graders Calvin Cain and Michael McLaurin explain to their classmates exactly how they went about it.

ional percentile points higher in math han nonveterans. "With a common xperience at the root of their lessons, hildren are not disadvantaged beause of their backgrounds," Acton ays. "Our kids can learn and learn vell if given the right approach."

But the Algebra Project offers no niracles. Where it has taken root, ften in inner cities, the streets are an rban grid plotted with negative numbers—crime, poverty, dropouts. In uburbs where students have home omputers, junior high algebra is a iven. But here? Yes, Moses says. Espeially here. "In the '60s everyone said harecroppers were apathetic, that hey didn't want to vote," he says after lass. "It wasn't until we got them denanding to vote that we got attention. Iere, where kids are falling wholesale hrough the cracks—or chasms—ropping out of sight, becoming fodler for jails, people say they don't want o learn. The only ones who can dispel hat notion are the kids themselves. Ve have to get them to demand what veryone says they don't want."

Making kids clamor for algebra is not as simple as solving for *x*. And moving students from arithmetic into algebra's unknowns can't be done overnight. Despite its name, the Algebra Project is really a pre-algebra project, supplementing regular math in the sixth and seventh grades. Its students may still learn fractions and decimals using traditional texts. But they may also spend several days, even weeks, in their new Algebra Project workbooks.

Based on a "five-step curricular process," the Project opens each lesson with an activity—playing a game or puzzling over a problem or taking a bus or subway trip. "The trip becomes an event, or step one," Moses explains. Step two gets the kids to reflect on the event. They may write stories about it, or draw pictures, or just talk it over. Step three involves breaking the event down into component parts, or "features": for a trip, this includes things like "start," "finish," "direction" and "stops along the way." In step four, students start assigning symbols to the features they've identified. By step five, the symbols have become part of their conversation, part of what Moses

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